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01 AERONAUTICS (GENERAL)

N76-19050* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES SUPPLEMENT (65), JANUARY 1976
Jan. 1976 81 p refs
(NASA-SP-7037(65)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 238 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1975. Author

N76-19051*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND TRANSONIC DYNAMIC STABILITY CHARACTERISTICS OF THE SPACE SHUTTLE LAUNCH VEHICLE
Delma C. Freeman, Jr., Richmond P. Boyden, and Edwin E. Davenport Washington Mar. 1976 68 p refs
(NASA-TM-X-3336; L-10378) Avail: NTIS HC $4.50 CSCL 01A

An investigation has been conducted to determine the subsonic and transonic dynamic stability characteristics of a 0.015 scale model of the space shuttle launch vehicle. These tests were conducted in the Langley 8-foot transonic pressure tunnel over a Mach number range from 0.3 to 1.2. Forced oscillation equipment was used to determine the damping characteristics of several configurations about all three axes. The test results show that the model exhibited positive damping in pitch except at the highest Mach number (1.2) where there was a region of negative damping at 2 deg angle of attack. The yawing oscillation tests show that the model exhibited nonlinearities and negative damping at Mach numbers of 0.3 and 0.6. The model exhibited positive roll damping throughout the test angle of attack and Mach range. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N76-19052 California Inst. of Tech., Pasadena.
A FLYING HOT WIRE STUDY OF THE TURBULENT NEAR WAKE OF A CIRCULAR CYLINDER AT A REYNOLDS NUMBER OF 140,000 Ph.D. Thesis
Brian Joseph Cantwell 1976 182 p
Avail: Univ. Microfilms Order No. 76-6523

An experiment was performed in the GALCIT 10-foot wind tunnel to study the flow in the near wake of a circular cylinder at a Reynolds number of 140,000. The main objective of this investigation was to study the phenomenology of the processes of vortex formation and transport in the near wake, at a Reynolds number sufficiently high to insure a fully turbulent wake, but low enough to insure a laminar separation. The latter requirement anticipates the eventual use of the results as a test case for advanced calculation codes. Much current experimental work on turbulent flows is concerned with large, coherent, organized cortex structures which have a relatively long lifetime and which account for much of the transport of mass, momentum and heat in turbulent shear flows. High Reynolds number flow past a cylinder is one case where such structures dominate. The apparatus developed for measuring this flow consists of X-ray hot wire probes mounted on the ends of a pair of whirling arms. In such a flow, where large changes on flow direction occur, a fixed hot wire would rectify the velocity signal and give ambiguous results. Dissert. Abstr.

N76-19053*# Old Dominion Univ. Research Foundation, Norfolk, Va.
FLEXSTAB ANALYSIS Final Report, Dec. 1974 - Jul. 1975
Harold E. Lowder, Jr. Feb. 1976 12 p refs
(Grant NsG-1093)
(NASA-CR-146435; TR-76-M1) Avail: NTIS HC $3.50 CSCL 01A

The wing differential pressure distributions of two vehicles are predicted using FLEXSTAB. Three space shuttle configurations were investigated. Comparisons were made of wind tunnel and analytical data for a selected range of angle of attack, angle of sideslip, and Mach number. A drone-type vehicle was investigated and comparisons were made between flight and analytical data of wing pressure distributions and static longitudinal stability derivatives. Author

N76-19054*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL INVESTIGATION OF THE EFFECT OF POROUS SPOILERS ON THE WAKE OF A SUBSONIC TRANSPORT MODEL
Victor R. Corsiglia and Vernon J. Rossow Jan. 1976 29 p refs
(NASA-TM-X-73091; A-6397) Avail: NTIS HC $4.00 CSCL 01A

Tests were conducted in the Ames Research Center 40- by 80-Foot Wind Tunnel to determine how porosity of wing spoilers on a B-747 airplane would affect the rolling moments imposed on an aircraft following in the wake. It was found that spoilers with 40 percent porosity and hole diameter to thickness ratio of 1.1 were just as effective in reducing the rolling moment imposed on the follower as solid spoilers, for the case of two spoilers per wing panel (6.4 percent semispan each) with a following model whose span was 20 percent of the span of the generator. When a larger following model was tested, whose span was 50 percent of that of the generator, the effectiveness of the two spoilers per wing was substantially reduced. Author

N76-19055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADVANCED SUPERSONIC TECHNOLOGY CONCEPT

AST-100 CHARACTERISTICS DEVELOPED IN A BASELINE-UPDATE STUDY

Hal T. Baber, Jr. and E. E. Swanson (Vought Corp., Hampton Tech. Gen.) 16 Jan. 1976 133 p refs

(NASA-TM-X-72815) Avail: NTIS HC $4.00 CSCL 01A

The advanced supersonic technology configuration, AST-100, is described. The combination of wing thickness reduction, nacelle recontouring for minimum drag at cruise, and the use of the horizontal tail to produce lift during climb and cruise resulted in an increase in maximum lift-to-drag ratio. Lighter engines and lower fuel weight associated with this resizing result in a six percent reduction in takeoff gross weight. The AST-100 takeoff maximum effective perceived noise at the runway centerline and sideline measurement stations was 114.4 decibels. Since 1.5 decibels tradeoff is available from the approach noise, the required engine noise supression is 4.9 decibels. The AST-100 largest maximum overpressure would occur during transonic climb acceleration when the aircraft was at relatively low altitude. Calculated standard +8 C day range of the AST-100, with a 292 passenger payload, is 7348 km (3968 n.mi). Fuel price is the largest contributor to direct operating cost. However, if the AST-100 were flown subsonically (M = 0.9), direct operating costs would increase approximately 50 percent because of time related costs. Author

N76-19056*# Kanner (Leo) Associates, Redwood City, Calif.

THE DOLPHIN AIRSHIP WITH UNDULATING DRIVE: UNDULATORS WITH RIGID OR ELASTIC BLADE WITH DIFFERENT UNDULATOR DIAMETER AT REST AND IN MOTION ON WHIRLING ARM

W. Schmidt Washington NASA Mar. 1976 13 p refs Transl. into ENGLISH from the German

(Contract NASw-2790)

(NASA-TT-F-16932) Avail: NTIS HC $3.50 CSCL 01C

Undulators with rigid or elastic blades are examined in terms of efficiency. The undulator with a rigid blade loses efficiency with decreasing undulator diameter in relation to blade depth. When the diameter is about 1/3 of the depth, the rigid undulator with 40% thickness delivers virtually no thrust at all and thus almost no forward motion. By contrast, the elastic undulator is much more efficient than the rigid one, and almost as efficient at small diameters as at large ones. This is particularly advantageous for the undulator drive of Dolphin airships because it can be designed considerably smaller. Author

N76-19057*# Scientific Translation Service, Santa Barbara, Calif.

DESIGN AND WIND TUNNEL MEASUREMENT OF A WING-BODY COMBINATION WITH SUPERCRITICAL AIRFOIL

A. Gustavsson and R. Vanino Washington NASA Mar. 1976 17 p refs Transl. into ENGLISH from Z. Flugwissenschaften (West Germany), v. 23, Jul.-Aug. 1975 p 257-262

(Contract NASw-2791)

(NASA-TT-F-16916) Avail: NTIS HC $3.50 CSCL 01A

A wind tunnel model with a wing of moderate aspect ratio and a supercritical airfoil was designed and high speed measurements were conducted. The principles of design are illustrated and the experimental results are discussed. For the wing design, a relaxation procedure for the calculation of the supercritical airfoil flow and a standard procedure for the calculation of the compressible wing body flow were used. The wind tunnel tests comprise six-component measurements, buffeting measurements, as well as oil flow and Schlieren pictures. Comparisons are made with a reference wing with a conventional airfoil combined with a cylindrical and a waisted body. The wing with supercritical airfoil gives an increase of the drag rise Mach number, shifting of buffet onset to higher lift coefficients and drag reduction for high lift coefficients. The body waisting leads to a considerable increase of the drag rise Mach number for the nonlifting case. Author

N76-19058*# Transemantics, Inc., Washington, D.C.

STUDY OF THE FLOW AROUND A CYLINDER AND OF ITS NEAR WAKE Ph.D Thesis

Pierre Trichet NASA Feb. 1976 151 p refs Transl. into ENGLISH of "Etude de l'Ecoulement Autour d'un Cylindre et de son Sillage Proche" Toulouse Univ., 1974 124 p

(Contract NASw-2792)

(NASA-TT-F-16844) Avail: NTIS HC $6.75 CSCL 01A

The near-wake flow around a circular cylinder placed into a bidimensional flow has been studied by hot wire anemometry in the 5500-13,000 Reynolds number range. The anemometric data yielded information on the kinematics of the wake (frequency, velocity and trajectory of vortices). The use of a miniaturized, sensitive pressure transducer permitted determination of the fluctuating pressure field at the surface of the cylinder. New findings on the flow field structure were obtained by means of correlation measurements between surface pressure and velocity in the adjacent unsteady potential flow of the circular cylinder. Results of the present study agree with those acquired by previous investigators. Author

N76-19059*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COLLECTED WORKS OF ROBERT T. JONES

Robert T. Jones Feb. 1976 1041 p refs

(NASA-TM-X-3334; A-6140) Avail: NTIS HC $28.25 CSCL 01A

Fluid dynamic principles are applied to airfoil stability and control problems, blood pump studies, and in relativistic kinematics. For individual titles, see N76-19060 through N76-19122.

N76-19060* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WING ANALYSIS: POBJOY RACEPLANE

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 3-20 refs (For availability see N76-19059 10-02) CSCL 01A

The Pobjoy raceplane is a light, low winged monoplane designed for high speed, maneuverability, and general high performance. The wing design for this plane is of the multispar type and not subject to a rigorous analysis. Resort was made to an approximate calculation supplemented by a static test on a section of the wing. The approximate method was completely verified and sufficient data obtained to design a wing for the racer. Several minor changes were made as follows: The shear bracing was changed from a Pratt trussing with tension strips to Warren truss of channel members, the truss members were centered on the outside of the beam flanges instead of on its neutral axis as before, the gauge of the material was increased and the size of the members decreased. These changes serve to strengthen the structure by reducing the possibility of local failure and increasing the allowable stress in the material. Author

N76-19061* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CALCULATION OF THE MOTION OF AN AIRPLANE UNDER THE INFLUENCE OF IRREGULAR DISTURBANCES

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 21-29 refs (For availability see N76-19059 10-02) CSCL 01A

The application of mathematical advances made in electricity and other branches to problems of airplane dynamics is demonstrated. The Heaviside-Bromwich methods of solution of linear differential equations are described and it is shown how these methods avoid the consideration of boundary conditions and of particular or complementary integrals. It is pointed out that if the solution of the differential equation is obtained for the case of a unit disturbance, the effect of varying disturbances may be found therefrom by Carson's theorem. A graphical solution of Carson's integral for irregular disturbances is given. The procedure of obtaining unit solutions of the equations is then taken up and the analogy between Heaviside's symbolic series solution and a physical procedure of approximation is shown. It is suggested that a fictitious impulsive disturbance be used in the treatment of initial motions. Author

N76-19062* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SIMPLIFIED APPLICATION OF THE METHOD OF OPERATORS TO THE CALCULATION DISTURBED MOTIONS OF AN AIRPLANE

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 31-44 refs (For availability see N76-19059 10-02)

(Rept-560) CSCL 01A

A simplified treatment of the application of Heaviside's operational methods to problems of airplane dynamics is given. Certain graphical methods and logarithmic formulas that lessen the amount of computation involved are explained. The problem of representing a gust disturbance or control manipulation is taken up and it is pointed out that in certain cases arbitrary control manipulations may be dealt with as though they imposed specific constraints on the airplane, thus avoiding the necessity of any integration whatever. Author

N76-19063* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EFFECT OF LATERAL CONTROLS IN PRODUCING MOTION OF AN AIRPLANE AS COMPUTED FROM WIND-TUNNEL DATA

Fred E. Weick and Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 45-72 refs (For availability see N76-19059 10-02)

(Rept-570) CSCL 01A

An analytical study of the lateral controllability of an airplane has been made in which both the static rolling and yawing moments supplied by the controls and the reactions due to the inherent stability of the airplane have been taken into account. A hypothetical average airplane, embodying the essential characteristics of both the wind tunnel models and the full size test airplanes, was assumed for the study. Computations made of forced rolling and yawing motions of an F-22 airplane caused by a sudden deflection of the ailerons were found to agree well with actual measurements of these motions. The conditions following instantaneous full deflections of the lateral control have been studied, and some attention has been devoted to the controlling of complete turn maneuvers. Author

N76-19064* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF THE TWO-CONTROL OPERATION OF AN AIRPLANE

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 73-90 refs (For availability see N76-19059 10-02)

(Rept-579) CSCL 01C

The two control operation of a conventional airplane is treated by means of the theory of disturbed motions. The consequences of this method of control are studied with regard to the stability of the airplane in its unconstrained components of motion and the movements set up during turn maneuvers. It is found that the motion of a conventional airplane is more stable when an arbitrary kinematic constraint is imposed in banking than when such constraint is imposed in yawing. Several hypothetical assumptions of piloting procedure, each of which is considered to represent a component of the actual procedure, are studied. Different means of two control operation are also discussed and it is concluded that a reliable rolling moment control that does not give the usual adverse secondary yawing moment should be most satisfactory. Author

N76-19065* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE REDUCTION OF AILERON OPERATING FORCE BY DIFFERENTIAL LINKAGE

Robert T. Jones and Albert I. Nerken *In its* Collected Works of Robert T. Jones Feb. 1976 p 91-115 refs (For availability see N76-19059 10-02)

(TN-586) CSCL 01C

It is shown that the control force of ordinary ailerons may be reduced to zero over a range of deflections and at a given flight condition by the use of an appropriate differential movement. Approximations to the ideal motion obtainable with a simple linkage are discussed and a chart that enables the selection of an appropriate crank arrangement is presented. Various aspects of the practical application of the system are discussed and it is concluded that a small fixed tab, deflected to trim both ailerons upward, would be advantageous. Author

N76-19066* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESUME AND ANALYSIS OF NACA LATERAL CONTROL RESEARCH

Fred E. Weick and Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 117-145 refs (For availability see N76-19059 10-02)

(Rept-605) CSCL 01C

An analysis of the principal results of recent lateral control research is made. Two things are considered of primary importance in judging the effectiveness of different control devices: The (calculated) banking and yawing motion of a typical small airplane caused by a deflection of the control, and the stick force required to produce this deflection. The report includes a table in which a number of different lateral control devices are compared on these bases. Test flights demonstrated that satisfactory lateral control at high angles of attack depends as much on the retention of stability as on aileron effectiveness. Author

N76-19067* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL STABILITY AND CONTROL CHARACTERISTICS OF WINGS WITH VARIOUS AMOUNTS OF TAPER AND TWIST

Henry A. Pearson and Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 147-165 refs (For availability see N76-19059 10-02)

(Rept-635) CSCL 01A

Stability derivatives have been computed for twisted wings of different planforms that include variations in both the wing taper and the aspect ratio. Taper ratios of 1.0, 0.50, and 0.25 are considered for each of three aspect ratios: 6, 10, and 16. The specific derivatives for which results are given are the rolling moment and the yawing moment derivatives with respect to rolling velocity, yawing velocity, and angle of sideslip. In addition to the stability derivatives, results are included for determining the theoretical rolling moment due to aileron deflection and a series of influence lines is given by which the loading across the span may be determined for any angle-of-attack distribution that may occur on the wing planforms considered. Author

N76-19068* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE INFLUENCE OF LATERAL STABILITY ON DISTURBED MOTIONS OF AN AIRPLANE WITH SPECIAL REFERENCE TO THE MOTIONS PRODUCED BY GUSTS

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 167-178 refs (For availability see N76-19059 10-02)

(Rept-638) CSCL 01A

Disturbed lateral motions have been calculated for a hypothetical small airplane with various modifications of fin area and dihedral setting. The modifications of the airplane include changes of dihedral and changes of weathercock stability. Fin area and wing dihedral were found to be of primary importance in side gusts. It was found that the rolling action of the wing with as much as 5 deg dihedral was distinctly unfavorable, especially when the weathercock stability was small. It is pointed out that the greatest susceptibility to lateral disturbances lies in the inherent damping and coupling moments developed by the wing. Author

N76-19069* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OPERATIONAL TREATMENT OF THE NONUNIFORM-LIFT THEORY IN AIRPLANE DYNAMICS

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 179-191 refs (For availability see N76-19059 10-02)

(TN-667) CSCL 01A

The method of operators is used in the application of nonuniform lift theory to problems of airplane dynamics. The method is adapted to the determination of the lift under prescribed conditions of motion or to the determination of the motions with prescribed disturbing forces. Author

N76-19070* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE UNSTEADY LIFT OF A WING OF FINITE ASPECT RATIO

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 193-202 refs (For availability see N76-19059 10-02)

(Rept-681) CSCL 01A

Unsteady lift functions for wings of finite aspect ratio have been calculated by correcting the aerodynamic inertia and the angle of attack of the infinite wing. The starting lift of the finite wing is found to be only slightly less than that of the infinite wing; whereas the final lift may be considerably less. Curves showing the variation of lift after a sudden unit change in angle of attack, during penetration of a sharp-edge gust and during a continuous oscillation are given. Operational equivalents of these functions have been devised to facilitate the calculation of lift under various conditions of motion. As an application of these formulas, the vertical acceleration of a loaded wing caused by penetrating a gust has been calculated. Author

N76-19071* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TRANSIENT EFFECTS OF THE WING WAKE ON THE HORIZONTAL TAIL

Robert T. Jones and Leo F. Fehlner *In its* Collected Works of Robert T. Jones Feb. 1976 p 203-220 refs (For availability see N76-19059 10-02)

(TN-771) CSCL 01A

The effect of wing wake on the lift of the horizontal tail surfaces was studied. In the development of expressions for this effect, the growth of wing circulation and wing wake, the time interval represented by the tail length, and the development of lift by the tail were considered. The theory has been applied to a specific case to show the magnitude of the effect to be expected. It is shown that, for motions below a certain frequency, the development of lift by the tail may be represented by a simple lag function. The lag is, however, somewhat greater than that indicated by the tail length. Author

N76-19072* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYSIS OF THE STABILITY OF AN AIRPLANE WITH FREE CONTROLS

Robert T. Jones and Doris Cohen *In its* Collected Works of Robert T. Jones Feb. 1976 p 221-234 refs (For availability see N76-19059 10-02)

(Rept-709) CSCL 01C

The conditions essential to the stability of an airplane with free control surfaces are studied. Calculations are based on typical airplane characteristics with certain factors varied to cover a range of current designs. The effects of reducing the chord and of eliminating the floating tendency of the surface, of changing the wing loading and of decreasing the radius of gyration of the airplane are indicated. An investigation has also been made of the nature of the motion of the airplane with controls free and of the modes of instability that may occur. Stability with the controls free generally depends more critically on the design of the control system than on the stability characteristics of the airplane. Author

N76-19073* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A GRAPHICAL METHOD OF DETERMINING PRESSURE DISTRIBUTION IN TWO-DIMENSIONAL FLOW

Robert T. Jones and Doris Cohen *In its* Collected Works of Robert T. Jones Feb. 1976 p 235-243 refs (For availability see N76-19059 10-02)

(Rept-722) CSCL 20D

By a generalization of the Joukowski method, a procedure is developed for effecting localized modifications of airfoil shapes and for determining graphically the resultant changes in the pressure distribution. The application of the procedure to the determination of the pressure distribution over airfoils of original design is demonstrated. Formulas for the lift, the moment, and the aerodynamic center are also given. Author

N76-19074* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THEORETICAL CORRECTION FOR THE LIFT OF ELLIPTIC WINGS

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 245-249 refs (For availability see N76-19059 10-02)

CSCL 01A

In the wing section theory the magnitude of the circulation, and hence of the lift, is determined by the velocity that would be induced near the trailing edge of the section in a non-lifting potential flow. In three dimensional flow the problem is complicated by the presence of the wake and no simple basic solution has been found. Treatment of the problem of a wing of finite span is reported on the basis of the two dimensional theory, corrected for the effect of the wake. Author

N76-19075* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOTES ON THE STABILITY AND CONTROL OF TAILLESS AIRPLANES

Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 251-280 refs (For availability see N76-19059 10-02)

(TN-837) CSCL 01C

Problems involved in the stability and control of tailless airplanes are discussed. Such factors as the location of the aerodynamic center and its effect on the longitudinal stability, longitudinal trim with high lift devices, the effects of various changes in the shape of the wing on lateral stability, and the effects of nacelles are covered. It appears that sufficient stability and controllability can be secured without sweepback. With sweepback, a flap over the center section of the wing may be used to serve the dual purpose of elevator control and high lift device. Sweepback introduces undesirable stalling characteristics, however, and may require auxiliary devices to prevent stalling of the tips. Author

N76-19076* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF CONTROL-SURFACE CHARACTERISTICS. 5: THE USE OF A BEVELED TRAILING EDGE TO REDUCE THE HINGE MOMENT OF A CONTROL SURFACE

Robert T. Jones and Milton B. Ames, Jr. *In its* Collected Works of Robert T. Jones Feb. 1976 p 281-305 refs (For availability see N76-19059 10-02)

(L-464) CSCL 01A

Wind tunnel tests have been made to investigate the possibility of reducing the hinge moments of a control surface by beveling the trailing edge. The tests were made with a 9 percent thick airfoil having a 30 percent chord plain flap. A faired beveled shape, 5 percent of the airfoil chord in width and having a thickness of 21/2 percent of the airfoil chord, was found to give approximately 50 percent reduction in the hinge moment caused by a given deflection of the flap and 80 percent reduction in the hinge moment due to the angle of attack of this airfoil for a wide range of angles. Elliptical trailing edge shapes were also tried but were found to be somewhat less effective. Author

N76-19077* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DETERMINATION OF OPTIMUM PLANFORMS FOR CONTROL SURFACES

Robert T. Jones and Doris Cohen *In its* Collected Works of Robert T. Jones Feb. 1976 p 307-314 refs (For availability see N76-19059 10-02)

(Rept-731) CSCL 01C

A theoretical analysis is made to determine the optimum chord distribution, location, and extent of control surfaces, with the ratio of hinge moment to effectiveness as the criterion. Expressions for the effectiveness - for ailerons, the rolling moment, and for tail surfaces, the change of lift on the tail due to deflection of the surface-were derived from lifting line theory. Solutions found for a range of airfoil planforms indicate that, regardless of the characteristics of the tail surface, the chord of the rudder or the elevator should be very nearly constant over its span. The optimum ailerons are also of a characteristics shape, varying little with the planform of the wing. Author

N76-19078* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EMERGENCY MEASURES FOR INCREASING THE RANGE OF FIGHTER AIRPLANES

Robert T. Jones and Joseph W. Wetmore *In its* Collected Works

of Robert T. Jones Feb. 1976 p 315-334 refs (For availability see N76-19059 10-02)
(L-223) CSCL 01A

An analysis was made to show the relative effectiveness of streamline external fuel tanks, a fuel tank in the form of a wing mounted in a biplane position, and auxiliary wing panels attached at the wing tips to increase the span as temporary means for increasing the range of a fighter-type airplane. Figures and charts for the various devices considered show the results of calculations of range, duration of flight, and take-off distance for both land base and carrier operation. The results indicated that the wing tip extensions were the most promising of the devices considered. Author

N76-19079* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF HINGE-MOMENT PARAMETERS ON ELEVATOR STICK FORCES IN RAPID MANEUVERS
Robert T. Jones and Harry Greenberg *In its* Collected Works of Robert T. Jones Feb. 1976 p 335-344 refs (For availability see N76-19059 10-02)
(Rept-798) CSCL 01C

The importance of the stick force per unit normal acceleration as a criterion of longitudinal stability and the critical dependence of this gradient on elevator hinge moment parameters are investigated with special reference to transient effects for maneuvers of short duration. The analysis shows that different combinations of elevator parameters, which give the same stick force per unit acceleration in turns, give widely different force variations during the entries into and recoveries from steady turns and during maneuvers of short duration such as abrupt pull-ups. The stick force per unit acceleration is greater for abrupt than for gradual control movements. Author

N76-19080* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL INVESTIGATION OF A BEVELED AILERON SHAPE DESIGNED TO INCREASE THE USEFUL DEFLECTION RANGE
Robert T. Jones and W. J. Underwood *In its* Collected Works of Robert T. Jones Feb. 1976 p 345-362 refs (For availability see N76-19059 10-02)
(L-651) CSCL 01A

Beveled ailerons were constructed with the bevel built up by spreading the upper and lower surfaces apart behind the hinge making a slight inside corner on each surface. During flight tests, it was noted that these ailerons showed a somewhat greater useful range of deflections and gave slightly better control at low speed than did original ailerons. Author

N76-19081* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR STUDYING THE HUNTING OSCILLATIONS OF AN AIRPLANE WITH A SIMPLE TYPE OF AUTOMATIC CONTROL
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 363-368 refs (For availability see N76-19059 10-02)
(Rept-801) CSCL 01C

A method is presented for predicting the amplitude and frequency, under certain simplifying conditions, of the hunting oscillations of an automatically controlled aircraft with lag in the control system or in the response of the aircraft to the controls. If the steering device is actuated by a simple right-left type of signal, the series of alternating fixed amplitude signals occuring during the hunting may ordinarily be represented by a square wave. Formulas are given expressing the response to such a variation of signal in terms of the response to a unit signal. Author

N76-19082* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPERTIES OF LOW-ASPECT-RATIO POINTED WINGS AT SPEEDS BELOW AND ABOVE THE SPEED OF SOUND
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 369-375 refs (For availability see N76-19059 10-02)
(Rept-835) CSCL 01A

Low aspect ratio wings having pointed planforms are treated on the assumption that the flow potentials in planes at right angles of the long axis of the airfoils are similar to the corresponding two dimensional potentials. For the limiting case of small angles of attack and low aspect ratios the theory brings out the following significant properties: (1) the lift of a slender pointed airfoil moving in the direction of its long axis depends on the increase in width of the sections in a downstream direction; (2) spanwise loading of such an airfoil is independent of planform and approaches the distribution giving a minimum induced drag; and (3) lift distribution of a pointed airfoil traveling point-foremost is relatively unaffected by the compressibility of the air below or above the speed of sound. Author

N76-19083* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WING PLANFORMS FOR HIGH-SPEED FLIGHT
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 377-383 refs (For availability see N76-19059 10-02)
(Rept-863) CSCL 01A

The analysis indicates that for aerodynamic efficiency, wings designed for flight at supersonic speeds should be swept back at an angle greater than the Mach angle and the angle of sweepback should be such that the component of velocity normal to the leading edge is less than the critical speed of the airfoil sections. This principle may also be applied to wings designed for subsonic speeds near the speed of sound, for which the induced velocities resulting from the thickness might otherwise be sufficiently great to cause shock waves. Author

N76-19084* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLOW OVER A SLENDER BODY OF REVOLUTION AT SUPERSONIC VELOCITIES
Robert T. Jones and Kenneth Margolis *In its* Collected Works of Robert T. Jones Feb. 1976 p 385-401 refs (For availability see N76-19059 10-02)
(TN-1081) CSCL 01A

The theory of small disturbances is applied to the calculation of the pressure distribution and drag of a closed body of revolution traveling at supersonic speeds. It is shown that toward the rear of the body the shape of the pressure distribution is similar to that for subsonic flow. For fineness ratios between 10 and 15 the theoretical wave drag is of the same order as probable values of the frictional drag. Author

N76-19085* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THIN OBLIQUE AIRFOILS AT SUPERSONIC SPEED
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 403-413 refs (For availability see N76-19059 10-02)
(Rept-851) CSCL 01A

Methods of thin airfoil theory have been extended to oblique or sweptback airfoils of finite aspect ratio moving at supersonic speeds. The cases considered thus far are symmetrical airfoils at zero lift having planforms bounded by straight lines. Because of the conical form of the elementary flow fields, the results are comparable in simplicity to the results of the two dimensional thin airfoil theory for subsonic speeds. In the case of untapered airfoils swept back behind the Mach cone the pressure distribution at the center section is similar to that given by the Ackeret theory for a straight airfoil. With increasing distance from the center section the distribution approaches the form given by the subsonic flow theory. The pressure drag is concentrated chiefly at the center section and or long wings a slight negative drag may appear on outboard sections. Author

N76-19086* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUBSONIC FLOW OVER THIN OBLIQUE AIRFOILS AT ZERO LIFT
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 415-423 refs (For availability see N76-19059 10-02)
(Rept-902) CSCL 01A

The pressure distribution over thin oblique airfoils at subsonic

speeds is studied. It is found that the flows again can be obtained by the superposition of elementary conical flow fields. In the case of the sweptback wing the pressure distributions remain qualitatively similar at subsonic and supersonic speeds. Thus a distribution similar to the Ackeret type of distribution appears on the root sections of the sweptback wing at M = 0. The resulting positive pressure drag on the root section is balanced by negative drags on outboard sections. Author

N76-19087* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ESTIMATED LIFT-DRAG RATIOS AT SUPERSONIC SPEED
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 425-471 refs (For availability see N76-19059 10-02)
(TN-1350) CSCL 01A

Recent developments in supersonic flow theory are applied to obtain estimates of the lift-drag ratios that may be achieved by aircraft employing sweptback wings. Lift-drag ratios greater than 10 to 1 can be maintained up to a Mach number of 1.4 by the use of large angles of sweep and high aspect ratios. As the speed increases in the supersonic range the attainable lift-drag ratios decrease and the gain due to sweepback also appears to diminish. An efficient configuration for M = 1.4 would require about 60 deg sweepback, an aspect ratio of 4 and a wing loading of one third the atmospheric pressure. For a wing loading of 50 pounds per square foot the cruising altitude would be 60,000 feet and the indicated airspeed 290 miles per hour. Author

N76-19088* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF SWEEPBACK ON BOUNDARY LAYER AND SEPARATION
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 473-482 refs (For availability see N76-19059 10-02)
(TN-1402) CSCL 01A

Following the law of stress adopted in the Navier-Stokes equations, the configuration of the viscous flow in planes at right angles to the axis of an infinite cylinder is found to be independent of the axial motion of the cylinder. In the limiting case of a yawed or swept wing of very high aspect ratio, certain boundary layer and separation phenomena are thus determined independently by the crosswise component of velocity. It follows that the effect of sweepback is to increase the area of stable laminar flow and to decrease the lift coefficient at which flow separation occurs. Author

N76-19089* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE USE OF CONICAL AND CYLINDRICAL FIELDS IN SUPERSONIC WING THEORY
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 483-497 refs (For availability see N76-19059 10-02)
CSCL 01A

Some of the recent advances in the theory of thin airfoils are presented with particular reference to extensions of the theory to three dimensional flows and to supersonic speeds. The problem discussed herein is the calculation of the small disturbance velocities u, v, and w in the external field produced by the flight velocity V of the airfoil. Author

N76-19090* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ECONOMY OF FLIGHT AT SUPERSONIC SPEEDS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 499-514 refs (For availability see N76-19059 10-02)
CSCL 05C

Prandtl's theory is used to determine the airflow over bodies and wings adapted to supersonic flight. By making use of these results, and by incorporating in them an allowance for the probable skin friction, some estimates of expected lift-drag ratios are made for various flight speeds with the best configuration. At each speed a slender body and wings having the best angle of sweepback are considered. For the range of supersonic speeds shown an airplane of normal density and loading would be required to operate at an altitude of the order of 60,000 feet. The limiting value of 1-1/2 times the speed of sound corresponds to a flight speed of 1000 miles per hour. At this speed about 1.5 miles per gallon of fuel are expected. It is interesting to note that this value corresponds to a value of more than 15 miles per gallon when the weight is reduced to correspond to that of an ordinary automobile. Author

N76-19091* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR PREDICTING THE STABILITY IN ROLL OF AUTOMATICALLY CONTROLLED AIRCRAFT BASED ON THE EXPERIMENTAL DETERMINATION OF THE CHARACTERISTICS OF AN AUTOMATIC PILOT
Robert T. Jones and Leonard Sternfield *In its* Collected Works of Robert T. Jones Feb. 1976 p 515-532 refs (For availability see N76-19059 10-02)
(TN-1901) CSCL 01C

A method is suggested for predicting the stability of automatically controlled aircraft by a comparison of calculated frequency-response curves for the aircraft and experimentally determined frequency-response curves for the automatic pilot. The method is applied only to stabilization in roll. The method is expected to be useful as a means of establishing the specifications of the performance required of the automatic control device for pilotless aircraft designed as missiles. Author

N76-19092* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEADING-EDGE SINGULARITIES IN THIN-AIRFOIL THEORY
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 533-538 refs (For availability see N76-19059 10-02)
CSCL 01A

If the thin airfoil theory is applied to an airfoil having a rounded leading edge, a certain error will arise in the determination of the pressure distribution around the nose. It is shown that the evaluation of the drag of such a blunt nosed airfoil by the thin airfoil theory requires the addition of a leading edge force, analogous to the leading edge thrust of the lifting airfoil. The method of calculation is illustrated by application to: (1) The Joukowski airfoil in subsonic flow; and (2) the thin elliptic cone in supersonic flow. A general formula for the edge force is provided which is applicable to a variety of wing forms. Author

N76-19093* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE SPANWISE DISTRIBUTION OF LIFT FOR MINIMUM INDUCED DRAG OF WINGS HAVING A GIVEN LIFT AND A GIVEN BENDING MOMENT
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 539-556 refs (For availability see N76-19059 10-02)
(TN-2249) CSCL 01A

The problem of the minimum induced drag of wings having a given lift and a given span is extended to include cases in which the bending moment to be supported by the wing is also given. The theory is limited to lifting surfaces traveling at subsonic speeds. It is found that the required shape of the downwash distribution can be obtained in an elementary way which is applicable to a variety of such problems. Expressions for the minimum drag and the corresponding spanwise load distributions are also given for the case in which the lift and the bending moment about the wing root are fixed while the span is allowed to vary. The results show a 15-percent reduction of the induced drag with a 15-percent increase in span as compared with results for an elliptically loaded wing having the same total lift and bending moment. Author

N76-19094* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE MINIMUM DRAG OF THIN WINGS IN FRICTIONLESS FLOW
Robert T. Jones *In its* Collected Works of Robert T. Jones

Feb. 1976 p 557-565 refs (For availability see N76-19059 10-02)
CSCL 01A

The assumptions of the thin airfoil theory are found to provide certain necessary conditions for the minimum drag of airfoils having a given total lift, a given maximum thickness, or a given volume. The conditions are applicable to steady or unsteady motions and to subsonic or supersonic speeds without restriction on the planform. The computation of drag and the statement of the conditions for minimum drag depend on the consideration of a combined flow field, which is obtained by superimposing the disturbance velocities in forward and reversed motions. If the planform of the airfoil and its total lift are given, it is found that, for minimum drag, the lift must be distributed in such a way that the downwash in the combined field is constant over the entire planform. If the planform is given and the thickness of the airfoil is required to contain a specified volume, then the thickness must be distributed over the planform in such a way that the pressure gradient of the combined field in the direction of flight is constant at all points of the wing. Author

N76-19095* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORETICAL DETERMINATION OF THE MINIMUM DRAG OF AIRFOILS AT SUPERSONIC SPEEDS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 567-578 refs (For availability see N76-19059 10-02)
CSCL 01A

A method is reported for determining mathematically the combined disturbance field, and in certain cases the minimum drag, of wings at supersonic speeds. The simplest analytic example is provided by the wing of elliptic planform, which achieves its minimum drag when the lift is distributed uniformly over the surface. With a symmetrical distribution of thickness, the requirement of minimum drag for a given total volume is found to lead to profiles of constant curvature. Author

N76-19096* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POSSIBILITIES OF EFFICIENT HIGH-SPEED TRANSPORT AIRPLANES
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 579-592 refs (For availability see N76-19059 10-02)
CSCL 01C

Comparisons of wing-body combinations may not disclose the full effect of a loss in aerodynamic efficiency. If the thrust needs to be increased at a given altitude then more or larger engines will have to be used and the possibility of concealing them becomes less. In this process the lift drag ratio of the complete airplane may become still more unfavorable than indicated by the comparison. Primarily aerodynamic and structural considerations point toward the development of turbojet engines specifically adapted to operation in an atmosphere of one tenth normal density. In addition to the numerous other technological problems associated with operation at these high altitudes, the problems of safe descent and effective limitation to low speeds at low altitudes seem important. Author

N76-19097* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MINIMUM WAVE DRAG FOR ARBITRARY ARRANGEMENTS OF WINGS AND BODIES
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 593-600 refs (For availability see N76-19059 10-02)
(Rept-1335) CSCL 01A

Various arrangements of wings and bodies designed to provide favorable wave interference at supersonic speeds lead to the problem of determining the minimum possible value of the wave resistance obtainable by any disposition of the elements of an aircraft within a definitely prescribed region. Under the assumptions that the total lift and the total volume of the aircraft are given, conditions that must be satisfied if the drag is to be a minimum are found. The report concludes with a discussion of recent developments of the theory which lead to an improved understanding of the drag associated with the production of lift. Author

N76-19098* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME RECENT DEVELOPMENTS IN THE AERODYNAMICS OF WINGS FOR HIGH SPEEDS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 601-608 refs (For availability see N76-19059 10-02)
CSCL 01A

The items discussed are: (1) a recently proposed correction formula for the effect of compressibility in two dimensional subsonic flow; (2) the equivalence rule and the area rule for transonic speeds; (3) reciprocal relations in linearized wing theory; and (4) some general results connected with the problem of minimum wave resistance. The paper concludes with an example showing indentation of the fuselage to obtain favorable interference with the wing at supersonic speeds. Author

N76-19099* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORY OF WING-BODY DRAG AT SUPERSONIC SPEEDS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 609-617 refs (For availability see N76-19059 10-02)
(Rept-1284) CSCL 01A

The relation of Whitcomb's area rule to the linear formulas for wave drag at slightly supersonic speeds is discussed. By adopting an approximate relation between the source strength and the geometry of a wing-body combination, the wave drag theory is expressed in terms involving the areas intercepted by oblique planes or Mach planes. The resulting formulas are checked by comparison with the drag measurements obtained in wind tunnel experiments and in experiments with falling models in free air. Finally, a theory for determining wing-body shapes of minimum drag at supersonic Mach numbers is discussed and some preliminary experiments are reported. Author

N76-19100* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE COMPRESSIBILITY RULE FOR DRAG OF AIRFOIL NOSES
Robert T. Jones and M. D. VanDyke *In its* Collected Works of Robert T. Jones Feb. 1976 p 619-623 refs (For availability see N76-19059 10-02)
CSCL 01A

It is shown that the drag of any semi-infinite airfoil section in purely subsonic inviscid flow follows precisely the Prandtl-Glauert compressibility rule. The result for the parabola has application to leading edge corrections in thin airfoil theory. Author

N76-19101* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC DESIGN FOR SUPERSONIC SPEEDS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 625-644 refs (For availability see N76-19059 10-02)
CSCL 01A

Recent theoretical and experimental work in supersonic aerodynamics is reviewed with its practical application in mind. Several arrangements of supporting surfaces and bodies are discussed and in some cases comparisons of theory and experiment are made. Finally, certain phenomena connected with lift and drag in a rarefied medium are considered briefly. Author

N76-19102* Avco-Everett Research Lab., Everett, Mass.
THREE-DIMENSIONAL WINGS OF MINIMUM PRESSURE DRAG
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 645-656 refs (For availability see N76-19059 10-02)
CSCL 01A

In linearized flow theory, certain very interesting extremal properties of wings can be derived under rather broad conditions without the use of a complicated mathematical apparatus. The present chapter reviews certain results of this theory and indicates some rather obvious extensions to incorporate various auxiliary conditions. Several examples illustrating the relation between the

geometrical features of the wing and the lift distribution for minimum drag are given. Author

N76-19103* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF WAVE DRAG BY ANTISYMMETRIC ARRANGEMENT OF WINGS AND BODIES
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 657-664 refs (For availability see N76-19059 10-02)
CSCL 01A

In theory, antisymmetric arrangements of wings and bodies can have smaller wave drag than corresponding mirror-symmetric arrangements. Thus, a long narrow oblique wing which presents the same aspect for two opposite directions of flight is potentially more efficient than corresponding (i.e., structurally equivalent) swept wing. The single continuous wing panel also adapts itself more readily to varying angles of obliquity, and hence, to varying flight speeds. Previous work on the aerodynamics and flight stability of oblique wing combinations is reviewed and a possible mode of application to transport aircraft operating at moderate supersonic speeds is suggested. Author

N76-19104* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEW DESIGN GOALS AND A NEW SHAPE FOR THE SST
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 665-671 refs (For availability see N76-19059 10-02)
CSCL 01C

New demands on the SST for better economy and less noise make it seem appropriate to consider a radically different concept of design. The shape suggested here: An almost perfectly conventional subsonic aircraft equipped with a straight wing of high aspect ratio, but with the wing arranged so that it can be turned to different oblique angles for flight at different Mach numbers. A wing which pivots as a whole would permit supersonic aircraft that both avoid sonic boom and reduce noise around airports. Author

N76-19105* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF THREE OBLIQUE-WING AND BODY COMBINATIONS AT MACH NUMBERS BETWEEN 0.60 AND 1.40
Lawrence A. Graham, Robert T. Jones, and Frederick W. Boltz *In its* Collected Works of Robert T. Jones Feb. 1976 p 673-848 refs (For availability see N76-19059 10-02)
(NASA-TM-X-62256) CSCL 01C

Transonic wind tunnel tests were conducted to determine the aerodynamic characteristics of three oblique high aspect ratio wings in combination with a high fineness ratio Sears-Haack body. The three wings had the same elliptical planform and base line curvature but had different airfoil sections. Notable differences were found in the aerodynamic characteristics of the three wing-body combinations, particularly in the lateral-directional characteristics. The aerodynamic efficiency of the three wing-body combinations was in most instances about the same, with two of the wings generally exhibiting slightly higher maximum values. The other wing was slightly more efficient at Mach numbers where super-critical flow existed on the wings. Author

N76-19106* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC TRANSPORT WINGS: OBLIQUE OR SWEPT?
Robert T. Jones and John W. Nisbet (Boeing Commercial Airplane Co.) *In its* Collected Works of Robert T. Jones Feb. 1976 p 849-858 refs (For availability see N76-19059 10-02)
CSCL 01C

In terms of gross weight, fuel consumption, and aircraft noise, an oblique wing aircraft looks best, and it shows acceptable aeroelastic stability; but its design characteristics and economic implications need further study. Author

N76-19107* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRCRAFT DESIGN FOR FLIGHT BELOW THE SONIC BOOM SPEED LIMIT
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 859-866 refs Presented at Quarter Century Symp., Toronto, 1 Apr. 1974 (For availability see N76-19059 10-02)
CSCL 01C

The avoidance of sonic booms places a constraint on aircraft design and can lead to unusual new configurations. From a comparison among several candidate designs, it is shown that an oblique winged aircraft offers many advantages when structure, stability, flight efficiency, and airport noise are considered jointly. Author

N76-19108* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AEROELASTIC CHARACTERISTICS OF AN OBLIQUE WING
Robert T. Jones and John W. Nisbet (Boeing Commercial Airplane Co.) *In its* Collected Works of Robert T. Jones Feb. 1976 p 867-883 refs (For availability see N76-19059 10-02)
CSCL 01C

In theory, the most efficient wing shape for transonic and low supersonic speeds is simply a long narrow straight subsonic wing turned at an oblique angle to the flight direction. This theory has been verified by tests at Mach numbers from .6 to 1.4 in supersonic wind tunnel and by comparative studies of transonic transport designs. Author

N76-19109* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMA OF MODIFIED GREGORIAN AND CASSEGRAINIAN MIRROR SYSTEMS **c74**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 885-894 refs Repr. from J. Optical Soc. Am., v. 44, no. 8, Aug. 1954 p 630-633 (For availability see N76-19059 10-02)
CSCL 20F

The equivalence of the classical Newtonian, Cassegrainian, and Gregorian mirror systems with respect to the first two Seidel aberrations is rederived by means of a simple congruence. The effects of arbitrary small modifications of the two mirror systems are then studied and general formulas are derived for the effects of such modifications on the spherical aberration and coma. Spherical aberration is corrected to the third order if the amount of glass removed from one surface is replaced at the corresponding zone of the other surface. Modifications in which one surface is made spherical while the other is adjusted to eliminate spherical aberration result in large increases of coma for systems having the usual amplifying ratios. Author

N76-19110* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A WIDE-FIELD TELESCOPE WITH SPHERICAL OPTICS **c74**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 895-901 (For availability see N76-19059 10-02)
CSCL 20F

Utilizing a doublet lens to correct the aberrations of a spherical mirror, a small f/8 telescope for visual use was designed and constructed. The lens has considerable negative power, so that it serves as a Barlow lens as well as a corrector. Author

N76-19111* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE SCIENCE: SOME SELECTED PROBLEMS AND ACCOMPLISHMENTS **c88**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 903-916 (For availability see N76-19059 10-02)
CSCL 22A

The development of scientific satellites is briefly discussed with emphasis on exhaust velocity enhancement by various propulsion system configurations. Also reported is the experimental production of artificial auroras at points separated by thousands of miles over the earth by creating relativistic electrons. G.G.

N76-19112* Avco-Everett Research Lab., Everett, Mass.
WIDE ANGLE LENSES WITH ASPHERIC CORRECTING SURFACES **c74**
Robert T. Jones *In* NASA. Ames Res. Center Collected Works

of Robert T. Jones Feb. 1976 p 917-922 refs Sponsored in part by Air Force (For availability see N76-19059 10-02)
CSCL 20F

Refracting elements having aspheric correcting surfaces near the center of curvature are analyzed. As in the case of the Schmidt reflector, such systems can have a wide aperture and a wide field of view; in addition, they are free from obstructing surfaces. Being uncorrected for dispersion, however, the refracting systems are restricted to nearly monochromatic radiation. Typical forms of the correcting surfaces have been determined, both by third order theory and by numerical integration of exact equations. Author

N76-19113* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIMES FOR INTERPLANETARY TRIPS **c13**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 923-925 (For availability see N76-19059 10-02)
CSCL 22A

The times required to travel to the various planets at an acceleration of one g are calculated. Surrounding gravitational fields are neglected except for a relatively short distance near take-off or landing. The orbit consists of an essentially straight line with the thrust directed toward the destination up to the halfway point, but in the opposite direction for the remainder so that the velocity is zero on arrival. A table lists the approximate times required, and also the maximum velocities acquired in light units v/c for the various planets. Author

N76-19114* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXTENDING THE LORENTZ TRANSFORMATION BY CHARACTERISTIC COORDINATES **c64**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 927-931 refs (For availability see N76-19059 10-02)
CSCL 12A

The problem considered is that of rectilinear motion with variable velocity. The paper gives, by an elementary construction, a system of coordinates which is conformal in a restricted region near the axis of the motion. In such coordinates the velocity of light remains invariant even for observers moving with variable velocity. By a particular choice of the scale relation the restricted conformal transformations can be made to reduce to the Lorentz transformation everywhere in the case of constant velocity and locally in the case of variable velocity. Author

N76-19115* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF ACCELERATED MOTION IN THE THEORY OF RELATIVITY **c70**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 933-937 refs (For availability see N76-19059 10-02)
CSCL 20J

Conventional treatments of accelerated motion in the theory of relativity have led to certain difficulties of interpretation. Certain reversals in the apparent gravitational field of an accelerated body may be avoided by simpler analysis based on the use of restricted conformal transformations. In the conformal theory the velocity of light remains constant even for experimenters in accelerated motion. The problem considered is that of rectilinear motion with a variable velocity. The motion takes place along the x or x' axis of two coordinate systems. Author

N76-19116* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFORMAL COORDINATES ASSOCIATED WITH UNIFORMLY ACCELERATED MOTION **c64**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 939-941 refs (For availability see N76-19059 10-02)
CSCL 12A

Specific problems in the theory of relativity are often simplified by an appropriate choice of the coordinate system. Restricted conformal coordinates provide an especially simple analysis of motion with uniform acceleration, known as hyperbolic motion. Conformal coordinates x', t' may be obtained from Cartesian coordinates x, t by the transformation $x' + ct' = F(x + ct)$ and $x' - ct' = G(x - ct)$, where c is the velocity of light. A variable motion of the x' system is determined by the choice of the functions F and G. Author

N76-19117* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFORMAL COORDINATES ASSOCIATED WITH SPACE-LIKE MOTIONS **c64**
Robert T. Jones *In its* Collected Works of Robert J. Jones Feb. 1976 p 943-956 refs (For availability see N76-19059 10-02)
CSCL 12A

Conformal transformations in two dimensions provide a simple extension of the Lorentz transformation. The velocity of light appears in such transformations as a singular velocity rather than as an upper limit for the velocity. A well ordered branch of the theory exists for velocities in excess of the velocity of light. If the velocity of a point exceeds the singular velocity in an inertial system, then the conformal representation of the motion is no longer uniform, but contains a folded region. However, the branching of the transformation may be determined so that the elapsed time along the path of such a motion remains positive. Kinematic relations on the other side of the singular velocity seem to complement the usual results of relativity theory in an interesting way. Thus it is known that motion at the speed of light occurs along a null geodesic, and hence corresponds in a certain sense to motion at infinite velocity. The complementary relation is that a motion of infinite velocity corresponds in the same sense to motion at the speed of light. Author

N76-19118* Avco-Everett Research Lab., Everett, Mass.
MOTIONS OF A LIQUID IN A PULSATING BULB WITH APPLICATION TO PROBLEMS OF BLOOD FLOW **c34**
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 957-965 refs Sponsored in part by Navy (For availability see N76-19059 10-02)
CSCL 20D

Potential flows may be utilized to represent motions produced in pulsating bulbs. While the initial bulb shape may be arbitrary, sequential shapes are related by affine transformations. Two components appear in the distribution of pressure, one dependent on the instantaneous velocity and the other on the acceleration. For flows with stationary streamlines the inertial impedance is that of a simple mass, and is proportional to the first moment of the actual mass of fluid contained within the bulb. Examples treated are: (1) Expanding and collapsing circular cylinders, and (2) elliptical cylinders in which the perimeter is held constant. The thickness of the pulsatile laminar boundary layer is found to be approximately on millimeter for conditions in the vicinity of the heart. Conditions for separation and turbulence differ from those in steady flow. Author

N76-19119* Avco-Everett Research Lab., Everett, Mass.
ELEMENTARY THEORY OF SYNCHRONOUS ARTERIO-ARTERIAL BLOOD PUMPS **c54**
Robert T. Jones, Harry E. Petscheck, and Arthur R. Kantrowitz *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 967-973 (For availability see N76-19059 10-02)
(Contracts AF 49(638)-1657; PH-43-66-1131)
CSCL 06B

In the technique of arterio-arterial pumping, a volume of fluid is withdrawn from the aorta during systole and reinjected during diastole, thereby reducing the systolic pressure of the heart and adding energy to the systemic circulation. It is found that an upper bound for the effectiveness of such devices is given by a formula that considers stroke output of the unaided heart and the increment caused by the pump with a stroke. The division of effort of the pump between the reduction of pressure and the increase of flow depends on the physiological mechanical impedance of the heart. The total effect is, however, independent of the impedance. Author

N76-19120* Avco-Everett Research Lab., Everett, Mass.
BLOOD FLOW **c52**
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 975-998 refs (For availability

see N76-19059 10-02)
CSCL 06P

A heuristic treatment of blood flow in the heart and the aorta together with some of the main branches considers the effects of fluid viscosity and vessel elasticity as well as pressure distribution in the typical pulsating flow. G.G.

N76-19121* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUID DYNAMICS OF HEART ASSIST DEVICE **c54**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 999-1017 refs Conf. paper presented at Specialists Meeting on Fluid Dynamics of Blood Circulation and Respirat. Flow, Naples, Italy, 4-6 May 1970 Sponsored in part by AFOSR
(For availability see N76-19059 10-02)
CSCL 06B

Certain hemodynamic phenomena that arise in connection with the use of artificial blood pumping devices are reviewed. Among these are: (1) Flows produced by collapsing bulbs; (2) the impedance presented by the aorta; (3) limiting velocities and instability of flow in elastic vessels; (4) effectiveness of valveless arterio-arterial pumps, and (5) wave reflection phenomena and instabilities associated with the intra-aortic balloon pump.Author

N76-19122* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMPLE VIOLIN OSCILLATOR **c71**
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 1019-1024 (For availability see N76-19059 10-02)
CSCL 20A

For acoustic tests the violin is driven laterally at the bridge by a small speaker of the type commonly found in pocket transistor radios. An audio oscillator excites the tone which is picked up by a sound level meter. Gross patterns of vibration modes are obtained by the Chladni method. G.G.

N76-19123*# Boeing Vertol Co., Philadelphia, Pa.
THEORY OF THE LIFTING AIRSCREW
V. E. Baskin, L. S. Vildgrube, Ye. S. Vozhdayev, C. I. Maykapar, and A. K. Martynov, ed. Washington NASA Feb. 1976 481 p refs Transl. into ENGLISH of the book "Teoriya Nesushchego Vinta" Moscow, Mashinostroyeniye Press, 1973 p 1-364 Sponsored in part by Army
(Contract NAS2-8081)
(NASA-TT-F-823) Avail: NTIS HC $12.50 CSCL 01A

The vortex theory, and some aspects of velocity potential were discussed. Oblique and axial translations of a lifting airscrew in an ideal fluid are considered first, within the limits of linear and nonlinear theories. Then, viscosity and compressibility effects are introduced. Exposition of some aspects of propeller operation in a compressible medium concludes this presentation. Author

N76-19124# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
OPTIMIZATION OF FREE FLIGHT MEASUREMENTS ON MISSILES [OPTIMIERUNG VON FREIFLUGMESSUNGEN AN FLUGKOERPERN]
L. Stiklorus Bonn DOKZENTBw 1974 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVG-FBWT-74-19) Avail: NTIS HC $4.50

A free flight analysis was applied on three different missiles to obtain aerodynamic stability coefficients. For two missiles the output data were received by using a digital computer program with realistic error inputs; for the third one, free flight measurement results were available. The analysis is based on the Newton-Raphson-method, applying the maximum-likelihood principle. Fundamental knowledge in choosing the measuring instruments and mounting them in the missile for obtaining optimal results was found. The influence of measuring time, missile stability, and moment of inertia on the quality of the results was also investigated. For the CZ- and Cm-coefficients, terms up to the fifth power are considered. The variation of the center of pressure location as function of Mach number, approximated by a polynomial of second power, was determined in the analysis of a ballistic missile during the boost phase. In all cases biases of output data and initial values of the state variables were computed. Author (ESA)

N76-19125# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
MAEP, A FORTRAN 4 PROGRAM SYSTEM FOR THE COMPUTATION OF AERODYNAMIC COEFFICIENTS OF MISSILES AND FOR THE PREPARATION OF WIND TUNNEL DATA FOR COMPARISON PURPOSES [MAEP, EIN FORTRAN-4 PROGRAMMSYSTEM FUER DIE BERECHNUNG AERODYNAMISCHER BEIWERTE VON FLUGKOERPERN UND FUER DIE AUFBEREITUNG VON WINDKANALERGEBNISSEN ZU VERGLEICHSZWECKEN]
D. Deppe Bonn DOKZENTBw 1974 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVG-FBWT-74-20) Avail: NTIS HC $4.00; DOKZENTBw DM 30

Three FORTRAN 4 computer programs are described, which allow the theoretical prediction of aerodynamic coefficients of missiles, and an evaluation of wind tunnel test results for the purpose of comparison as well as the graphical presentation of such a comparison between the theoretical and the test results. The theoretical prediction method is based on the method of coefficient synthesis. The underlying aerodynamics of wings, bodies, and interference is discussed. Good agreement is shown between theoretical and experimental results in a wide range of angle of attack and Mach number for a typical missile configuration. Author (ESA)

N76-19126# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
PROJECT SQUID Semiannual Progress Report, 1 Apr. - 30 Sep. 1975
T. Adamson, J. Broadwell, E. Browand, E. Bruce, F. Carta, J. Fenn, A. Fontijn, J. Foss, M. Lapp, S. Lederman et al Oct. 1975 96 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A016842) Avail: NTIS CSCL 20/4

Reports of progress during the past six months on the 18 research programs comprising Project Squid are presented. The research programs fall into the areas of Aerodynamics and Turbo Machinery, Combustion and Chemical Kinetics, Measurements and Turbulence. Project SQUID is a cooperative program of basic research related to jet propulsion. It is administered by Purdue University and sponsored by the Office of Naval Research. GRA

N76-19127# Wisconsin Univ., Madison. Dept. of Computer Sciences.
HIGH REYNOLDS NUMBER FLOW BETWEEN ROTATING COAXIAL DISKS: A NUMERICAL EXPERIMENT
John H. Cerutti 8 Apr. 1975 17 p refs
(Contracts N00014-67-A-0128-0004; DA-31-124-ARO(D)-462)
(AD-A016686; TR-249) Avail: NTIS CSCL 20/4

A pair of nonlinear ordinary differential equations that arise in the study of fluid flow between rotating coaxial disks is studied numerically. Collocation at Gaussian points is used to find approximate solutions to these equations for different values of the ratio of the angular velocity of one disk to the other. Recently J. B. McLeod and S. V. Parter have proved rigorous analytic results for the case when the disks rotate with equal and opposite angular velocity. A comparison between their analytic results and the numerical results is presented for this case. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N76-19128 Massachusetts Univ., Amherst.
DYNAMICS OF A SLUNG LOAD Ph.D. Thesis
Lewis Lavon Feaster 1975 179 p
Avail: Univ. Microfilms Order No. 76-5851

The yaw damping coefficient of a box shaped container is

experimentally determined by forced oscillation tests. The particular testing method relies on a Taylor expansion of the aerodynamic moment and certain distinctive features of vector lock-in detection. The result is then used in linearized small perturbation stability analyses of a sling load considering both single cable and two cable, tandem suspension systems. The effect of attaching stabilizing fins to the container and of incorporating a rotating wheel for stability augmentation is also investigated. The results show that the two cable, tandem suspension system may offer a satisfactory means of transporting the standard cargo container throughout the speed range of most present day cargo helicopters. Dissert. Abstr.

N76-19129*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMULATOR EVALUATION OF TENTATIVE STOL AIRWORTHINESS CRITERIA. VOLUME 1: SIMULATION RESULTS AND ANALYSIS
Robert K. Heffley (Systems Technology, Inc., Mountain View, Calif.), John M. Lehman (Systems Technology, Inc., Mountain View, Calif.), Robert C. Rumold (Systems Technology, Inc., Mountain View, Calif.), Robert L. Stapleford (Systems Technology, Inc., Mountain View, Calif.), Barry C. Scott (FAA, Moffett Field, Calif.), and Charles S. Hynes Nov. 1975 147 p refs
(Contract NAS2-7926)
(NASA-TM-X-73093; A-6402-Vol-1; FAA-RD-75-222-Vol-1; STI-TR-1047-3-Vol-1) Avail: NTIS HC $6.00 CSCL 01C

A simulation program was conducted to examine specific airworthiness criteria proposed by the STOL Standards Development Working Group. The simulation included an airplane model which was deliberately designed to just meet as many of the proposed criteria as possible. The specific areas of investigation were longitudinal flight path/flight reference control, limiting flight conditions and safety margins, and propulsion system failure. Simulation results largely confirmed the approaches taken by the Working Group and aided in providing additional numerical definition of criteria. Author

N76-19130*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMULATOR EVALUATION OF TENTATIVE STOL AIRWORTHINESS CRITERIA. VOLUME 2: BACKGROUND INFORMATION
Robert K. Heffley (Systems Technology, Inc., Mountain View, Calif.), John M. Lehman, Robert L. Stapleford (Systems Technology, Inc., Mountain View, Calif.), Barry C. Scott (FAA, Moffett Field, Calif.), and Charles S. Hynes Nov. 1975 178 p refs
(Contract NAS2-7926)
(NASA-TM-X-73094; A-6403-Vol-2; FAA-RD-75-222-Vol-2; STI-TR-1047-3-Vol-2) Avail: NTIS HC $7.50 CSCL 01C
For abstract, see N76-19129.

N76-19131# Committee on Commerce (U. S. Senate).
REPORT ON THE OVERSIGHT HEARINGS AND INVESTIGATION OF THE DC-10 AIRCRAFT
Washington GPO 1974 50 p Rept. prepared by Aviation Subcomm. for Comm. on Commerce, 93d Congr., 2d Sess., Jun. 1974
(GPO-33-379) Avail: Subcomm. on Aviation

The hearings are reported concerning the accident, near Paris, of the DC-10 operated by the THY in which 346 persons were killed. The investigators concluded that the accident was caused by separation of the aft bulk cargo door while the aircraft was climbing to its assigned crusing altitude. The instantaneous decompression caused the cabin floor to buckle severing or damaging the flight control cables. The history of the DC-10 door problem is reviewed including the Service Bulletin for modifying and adjusting the door mechanism assembly. It was found that the FAA failed to take proper regulatory action in seeking to ensure that a repeat of door failure did not occur; and that the Douglas Aircraft Company did not take the kind of remedial action on the cargo door situation, which circumstances warranted. F.O.S.

N76-19132# LTV Aerospace Corp., Dallas, Tex.
SENDS ESCAPE ALERT SYSTEM DEVELOPMENT PROGRAM. PHASE 2: AIRCRAFT/AIRCREW ANALYSIS. PHASE 3: AIRCRAFT COMPUTER PROGRAM Final Report, 9 Dec. 1974 - 28 Mar. 1975
Edwin O. Cartwright, Thomas L. Harper, George D. Sepp, Robert L. Dauber, and Albert L. Hauschild May 1975 90 p refs
(Contract N62269-74-C-0523)
(AD-A016271; NADC-95190-40) Avail: NTIS CSCL 06/7

The SENDS system is designed to provide the aircrewman with a continuous indication of inflight escape capability. The concept, as conceived by VSD, monitors the aircraft dynamic correlation by means of onboard sensors, provides these data to an onboard computer which computes escape capability in accordance with NATOPS manual criteria, and then displays the current status in terms of time remaining to indicate an ejection and still be within the safe recovery envelope of the escape system. GRA

N76-19133# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORTS. BRIEF FORMAT US CIVIL AVIATION ISSUE NUMBER 1 OF 1975 ACCIDENTS
4 Sep. 1975 523 p refs
(PB-245771/1; NTSB-BA-75-4) Avail: NTIS HC $12.25; MF $3.25 (special price) CSCL 01B

Selected aircraft accident reports, occurring in U.S. civil aviation operations during calendar year 1975 are presented. The 896 general aviation accidents contained in this publication represent a random selection. The publication is issued irregularly, normally five times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of flight, pilot certificate, injuries, and causal factors. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-19134*# Kanner (Leo) Associates, Redwood City, Calif.
A NEW COMPASS FOR AERONAUTICAL NAVIGATION
H. Bohli Washington NASA Mar. 1976 14 p refs Transl. into ENGLISH from Aero-Revue (West Germany), Apr. 1973 p 186-189
(Contract NASw-2790)
(NASA-TT-F-16915) Avail: NTIS HC $3.50 CSCL 17G

A compass device is described which provides adequate service during turns of the aircraft to the north or to the south. This is accomplished by a design which makes it possible for the magnetic needle to turn freely within certain limits around two orthogonal axes. It is pointed out that the new device is particularly suited for glider navigation applications. Author

N76-19135*# Ohio Univ., Athens. Avionics Engineering Center.
A PROPOSED MICROCOMPUTER IMPLEMENTATION OF AN OMEGA NAVIGATION PROCESSOR
John D. Abel Mar. 1976 10 p refs
(Grant NGR-36-009-107)
(NASA-CR-146532; TM-23) Avail: NTIS HC $3.50 CSCL 17G

A microprocessor navigation systems using the Omega process is discussed. Several methods for correcting incoming sky waves are presented along with the hardware design which depends on a microcomputer. The control program is discussed, and block diagrams of the Omega processor and interface systems are presented. F.O.S.

N76-19136*# Ohio Univ., Athens. Avionics Engineering Center.
POSSIBLE METHODS FOR USSR-VLF NAVIGATION RECEIVERS

Ralph W. Burhans Mar. 1976 10 p refs
(Grant NGR-36-009-107)
(NASA-CR-146637; TM-22) Avail: NTIS HC $3.50 CSCL 17G

The U.S.S.R. has a VLF navigation system similar to OMEGA. Beukers has reported some information on the signal format, frequencies used, and the probable radiated power levels. From this data it appears possible to derive receiver operation modes and some implied reasons for the unique choice of the time-multiplexed frequency time base used. Of interest are receiver methods requiring processor gate complexity similar to a digital wristwatch including the use of mass-produced low frequency quartz crystal reference oscillators. The stability required of the local reference oscillator is probably much less critical than for other VLF receivers because of the signal format. One conclusion is that U.S.S.R.-VLF receivers might be fabricated at quite low cost making it possible for all persons in remote areas each to have his own private positioning aid. Further study of the actual transmitted signal format is warranted. While the nature of this memorandum is speculative because of the lack of confirming data, the receiver method proposed has evolved from related principles which have been applied to the operating OMEGA-VLF navigation system. Author

N76-19137# Airborne Instruments Lab., Farmingdale, N.Y.
SCALE MODEL LOCALIZER FACILITY Interim Report, Sep. 1973 - Jun. 1975
Neil J. Creedon Jul. 1975 26 p
(AD-A018370; FGS-A414-2; FAA-RD-75-204) Avail: NTIS HC $4.00 CSCL 17/7

The fabrication of a 1/30 scale model localizer system is described. The process used to achieve the required amplitude modulation of a 3 GHz carrier is detailed. Author

N76-19138# Army Scientific Advisory Panel, Washington, D.C.
REPORT OF THE AD HOC GROUP ON LORAN MANPACK
James Angell, Robert Lockerd, William Murray, Dan Leonard, and Richard Montgomery 22 Aug. 1975 16 p
(AD-A017402) Avail: NTIS CSCL 17/7

The principal purpose of the review was to analyze the objectives and status of the present program as an assist in determining present and future direction. GRA

N76-19139# Naval Electronics Lab. Center, San Diego, Calif.
OMEGA MEASUREMENTS: HMS VIDAL. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 21: DATA FOR PERIOD MAY - SEPTEMBER 1966
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 112 p refs
(NELC Proj. A107)
(AD-A017361; NELC-TD-411-Vol-21) Avail: NTIS CSCL 17/7

One of a series of 27 (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. The data documented in the report were obtained during a cruise of the British hydrographic survey ship HMS VIDAL during the summer of 1966. Previous data from similar voyages have been documented in NEL Technical Report 1350, OMEGA IN THE ATLANTIC, which describes the results of the Omega monitoring during oceanographic survey Project NAVADO of 1963-1965. GRA

N76-19140# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPUTER ERROR ANALYSIS OF TROPOSPHERIC EFFECTS FOR THE NAVSTAR GLOBAL POSITIONING SYSTEM M.S. Thesis
John R. Schmidt, III Jan. 1975 73 p refs
(AD-A017183; GE/EE/75-7) Avail: NTIS CSCL 17/7

A model for tropospheric delay of a radio signal from a satellite, is used to perform a three-dimensional tropospheric error analysis for the NAVSTAR Global Positioning System (GPS). A program to evaluate the error as a function of satellite positions and elevations, user altitude, and surface index of refraction is developed. It is found that the order of magnitude of the tropospheric errors is such that these errors are not an impediment to possible aircraft precision approaches using NAVSTAR. An extensive bibliography of NAVSTAR and satellite navigation literature is included. GRA

N76-19141# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
INERTIAL POSITIONING SYSTEM TEST DATA
Sep. 1975 117 p
(Contract DAAK02-74-C-0182)
(AD-A017477; G/CSD-403209; ETL-0028) Avail: NTIS CSCL 17/7

The report presents the results of the Acceptance Tests conducted on the Inertial Positioning System (IPS). Included in this report is a system error analysis for comparison with the specification requirements. As the tests progressed, problems associated with elevation accuracies were resolved. As a result, the elevation accuracies achieved during the latter part of the Field Acceptance Tests were excellent. A total of 10 missions was performed over a government-selected and established course in Southern California. The IPS fulfilled the contractual requirements with the exception of the azimuth accuracy specification using azimuth update and the ambient temperature requirements above 115F, where azimuth drift was excessive. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-19142*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC WIND-TUNNEL TESTS OF AN F-8 AIRPLANE MODEL EQUIPPED WITH 12 AND 14-PERCENT THICK OBLIQUE WINGS
Ronald C. Smith, Robert T. Jones, and James L. Summers Oct. 1975 158 p refs
(NASA-TM-X-62478; A-6259) Avail: NTIS HC $6.75 CSCL 01C

An experimental investigation was conducted in the Ames 14-foot transonic wind tunnel to study the aerodynamic performance and stability characteristics of a 0.087-scale model of an F-8 airplane fitted with an oblique wing. Two elliptical planform (axis ratio = 8:1) wings, each having a maximum thickness of 12 and 14 percent, were tested. Longitudinal stability data were obtained with no wing and with each of the two wings set at sweep angles of 0, 45, and 60 deg. Lateral directional stability data were obtained for the 12 percent wing only. Test Mach numbers ranged from 0.6 to 1.2 in the unit Reynolds number range from 11.2 to 13.1 million per meter. Angles of attack were between -6 and 22 deg at zero sideslip. Angles of sideslip were between -6 and +6 deg for two angles of attack, depending upon the wing configuration. Author

N76-19143*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A COMPUTER PROGRAM INCORPORATING FATIGUE AND FRACTURE CRITERIA IN THE PRELIMINARY DESIGN OF TRANSPORT AIRCRAFT: AN EVALUATION Final Report, Dec. 1974 - Jul. 1975
Paul E. Berger and Earl A. Thornton Mar. 1976 12 p ref
(Grant NsG-1093)
(NASA-CR-146506; TR-76-M2) Avail: NTIS HC $3.50 CSCL 01C

The APAS program a multistation structural synthesis procedure developed to evaluate material, geometry, and configuration with various design criteria usually considered for the primary structure of transport aircraft is described and evaluated. Recommendations to improve accuracy and extend the capabilities of the APAS program are given. Flow diagrams are included. J.M.S.

N76-19144*# Lockheed-California Co., Burbank.
STUDY OF LH2 FUELED SUBSONIC PASSENGER TRANSPORT AIRCRAFT Final Report, Jul.-Dec. 1975
G. D. Brewer and R. E. Morris Jan. 1976 166 p refs
(Contract NAS1-12972)
(NASA-CR-144935; LR-27446) Avail: NTIS HC $6.75 CSCL 01C

The potential of using liquid hydrogen as fuel in subsonic transport aircraft was investigated to explore an expanded matrix of passenger aircraft sizes. Aircraft capable of carrying 130 passengers 2,780 km (1500 n.mi.); 200 passengers 5,560 km (3000 n.mi.); and 400 passengers on a 9,265 km (5000 n.mi.) radius mission, were designed parametrically. Both liquid hydrogen and conventionally fueled versions were generated for each payload/range in order that comparisons could be made. Aircraft in each mission category were compared on the basis of weight, size, cost, energy utilization, and noise. Author

N76-19145*# Bell Helicopter Co., Fort Worth, Tex.
CONCEPTUAL DESIGN STUDY OF 1985 COMMERCIAL TILT-ROTOR TRANSPORTS. VOLUME 4: STOL SUBSTANTIATING DATA
K. W. Sambell 16 Sep. 1975 82 p
(Contract NAS2-8259)
(NASA-CR-137765; D313-099-002-Vol-4) Avail: NTIS HC $5.00 CSCL 01C

The STOL substantiating data are presented of a conceptual design study of 1985 commercial tilt rotor V/STOL transports. Author

N76-19146*# Systems Control, Inc., Palo Alto, Calif.
ANALYTICAL EVALUATION OF TILTING PROPROTOR WIND TUNNEL TEST REQUIREMENTS Technical Report, 1 Apr. - 15 Dec. 1975
W. Earl Hall, Jr. and Deborah Buenz Jan. 1976 144 p refs
(Contract NAS2-8799)
(NASA-CR-137826) Avail: NTIS HC $6.00 CSCL 01A

Specific test requirements related to the wind tunnel testing of the XV-15 advanced tilt rotor research aircraft were determined. The following analytical tools were developed: (1) digital simulation of the XV-15, incorporating a simplified tunnel support model, control system loop, measurement lags, gust disturbances, and sensor noise, (2) specialization of existing data analysis programs to the high order XV-15 dynamical model (transfer function program, a time series analysis program, an advanced maximum likelihood parameter identification program), (3) several auxiliary programs to provide estimates of damping from transfer functions as well as calculations of model decomposition of system response. The following results were discussed: (1) modelling of the aircraft, instrumentation, and controls, (2) results of the rotor/cantilever wing model and coupled wing, (3) examples of data prediction with system identification techniques, and (4) detailed conclusions and recommendations. Y.J.A.

N76-19147*# Lockheed-California Co., Burbank.
STUDY OF FLUTTER RELATED COMPUTATIONAL PROCEDURES FOR MINIMUM WEIGHT STRUCTURAL SIZING OF ADVANCED AIRCRAFT Final Report
R. F. OConnell, H. J. Hassig, and N. A. Radovcich Mar. 1976 127 p refs
(Contract NAS1-12121)
(NASA-CR-2607; LR-26650) Avail: NTIS HC $6.00 CSCL 01C

Results of a study of the development of flutter modules applicable to automated structural design of advanced aircraft configurations, such as a supersonic transport, are presented. Automated structural design is restricted to automated sizing of the elements of a given structural model. It includes a flutter optimization procedure; i.e., a procedure for arriving at a structure with minimum mass for satisfying flutter constraints. Methods of solving the flutter equation and computing the generalized aerodynamic force coefficients in the repetitive analysis environment of a flutter optimization procedure are studied, and recommended approaches are presented. Five approaches to flutter optimization are explained in detail and compared. An approach to flutter optimization incorporating some of the methods discussed is presented. Problems related to flutter optimization in a realistic design environment are discussed and an integrated approach to the entire flutter task is presented. Recommendations for further investigations are made. Results of numerical evaluations, applying the five methods of flutter optimization to the same design task, are presented. Author

N76-19148# Technische Hogeschool, Delft (Netherlands).
FLUTTER ANALYSIS OF A PLASTIC GLIDER [FLUTTERANALYSE VAN EEN KUNSTSTOF ZWEEFVLIEGTUIG]
P. C. Hensing Sep. 1974 35 p refs In DUTCH
(VTH-187) Avail: NTIS HC $4.00

The vibration and flutter behavior of the Standard Cirrus plastic glider was investigated. Vibration tests were carried out and results were used to verify the mathematical model. Vibration and flutter calculations were carried out for the wing and tail. The unsteady aerodynamic forces on the T tail were also calculated. The transferrability of the results to other plastic gliders was examined. ESA

N76-19149# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
TITANIUM STRUCTURES IN COMMERCIAL SUBSONIC AIRCRAFT
R. J. H. Wanhill Oct. 1974 19 p refs Presented at the 6th Intern. Light Metals Conf., Leoben, Austria, and Vienna, Jun. 1975
(NLR-MP-74030-U) Avail: NTIS HC $3.50

Advanced aluminum and titanium reinforced composites exhibit significant advances over conventional skin-stiffener aluminum alloy structures in terms of weight, fatigue strength, and fatigue crack propagation resistance. Comparison of advanced concepts show that composite-reinforced titanium structures exhibit the best combination of properties, even if material and fabrication costs are higher compared to aluminum. Trade-offs between costs, weight-reduction, and crack tolerance are indicated. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-19150 Purdue Univ., Lafayette, Ind.
PROPAGATION OF SUPERSONIC ROTOR SOUND RADIATIONS IN JET ENGINE INLET DUCTS Ph.D. Thesis
Gholam Reza Shashaani 1975 273 p
Avail: Univ. Microfilms Order No. 76-7133

Multiple pure tone noise is generated by a pattern of rotating shock waves in the inlet of turbofan engines when the relative tip speed of the fan blades is supersonic. In conjunction with this problem, the propagation of nonaxisymmetric sound waves in a lined duct with various wall conditions is analyzed both theoretically and experimentally. The theory of acoustic modules is employed to determine the attenuation rate of sound waves and optimum values of linear impedances. Numerical values for these parameters are obtained for ducts of rectangular and circular cross sections. A single, nondimensional parameter obtained by combining the frequency, impedance, and duct dimension was

optimized instead of the individual variables. Experiments were performed for higher order mode, low intensity and finite amplitude sound waves with hard and soft wall conditions. Theoretical and experimental results are compared. Dissert. Abstr.

N76-19151*# Kanner (Leo) Associates, Redwood City, Calif.
NOISE REDUCTION IN JET AIRCRAFT
A. M. Mikhitaryan, V. G. Yenenkov, B. N. Melnikov, V. I. Tokarev, and I. P. Shmakov Washington NASA Jan. 1976 252 p refs Transl. into ENGLISH of the book "Snizheniye Shuma Samoletov s Reaktivnymi Dvigatelyami" Moscow, Mashinostroyeniye Press, 1975 263 p
(Contract NASw-2790)
(NASA-TT-F-16637) Avail: NTIS HC $9.00 CSCL 20A

The results are presented of studies of the acoustic characteristics of the noise of aircraft with reaction engines. The problems of rating the noise of planes and engines are reviewed along with criteria for evaluating the irritating effect of airplane noise. On the basis of analysis of the basic sources of aircraft noise recommendations are developed for reducing noise both at its source and along the path of its propagation. The presented material may be used in the selection of parameters of reaction engines which are optimal with respect to noise. A mathematical model is developed which makes it possible to choose optimal airplane control, which would ensure reduction of noise on the ground. Methods of reducing aviation noise, questions of limiting construction in the vicinity of airports, and technical-economic effectiveness of noise reduction methods are also considered.
Author

N76-19152*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
STATUS OF THE NASA YF-12 PROPULSION RESEARCH PROGRAM
James A. Albers Mar. 1976 32 p refs
(NASA-TM-X-56039; H-935) Avail: NTIS HC $4.00 CSCL 21E

The YF-12 research program was initiated to establish a technology base for the design of an efficient propulsion system for supersonic cruise aircraft. The major technology areas under investigation in this program are inlet design analysis, propulsion system steady-state performance, propulsion system dynamic performance, inlet and engine control systems, and airframe/propulsion system interactions. The objectives, technical approach, and status of the YF-12 propulsion program are discussed. Also discussed are the results obtained to date by the NASA Ames, Lewis, and Dryden research centers. The expected technical results and proposed future programs are also given. Propulsion system configurations are shown.
Author

N76-19153*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ALTERNATIVES FOR JET ENGINE CONTROL Semiannual Status Report, 1 Mar. 1975 - 29 Feb. 1976
R. J. Leake and M. K. Sain 29 Feb. 1976 18 p refs
(Grant NsG-3048)
(NASA-CR-146531) Avail: NTIS HC $3.50 CSCL 21E

Alternatives to currently used design methods which rely heavily on linear quadratic and Riccati equation methods are discussed. The progress toward original research objectives is described. Included are development of an IBM 370 user manual and simple control studies related to the installation of the DYNGEN, development of simple turbojet models and control studies with an analog simulation, computation of time optimal controls with surge and inlet constraints, polynomial design studies related to the multivariable control of Michael Farrar jet engine models and the evaluation of MacFarlane's technique as a design tool for control of linearized models of jet engines.
Author

N76-19154# Environmental Protection Agency, Washington, D.C. Library Systems Branch.
AIRCRAFT NOISE CERTIFICATION RULE FOR SUPERSONIC CIVIL AIRCRAFT
24 Jan. 1975 159 p
(PB-245802/4) Avail: NTIS HC $6.75 CSCL 20A

Supporting data are presented for a proposed noise certification rule for supersonic civil aircraft. Topics discussed include: the differences between super subsonic aircraft; idealized model airports; the effects on noise exposure to the airport neighborhood community of the introduction of various rates of operation of supersonic airplanes into a subsonic airplane fleet. Analyses of potential costs and noise control are included. GRA

N76-19155# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
RESEARCH ON NOISE GENERATED BY DUCTED AIR-FUEL COMBUSTION SYSTEMS Annual Report, Mar. 1974 - Jul. 1975
E. G. Plett, H. J. Shafer, and M. Summerfield Aug. 1975 47 p refs
(Contracts N00014-67-A-0150-0029; N00014-75-C-0507)
(AD-A015688; AR-4) Avail: NTIS CSCL 21/5

A two-pronged approach to the study of noise generation by combustion in a confined flow system, similar to a jet engine configuration, has been followed. One aspect deals with the mechanisms of noise generation by combustion; the other aspect deals with the effect of confinement on the noise generation and radiating properties of an unsteady combustion-duct-flow interaction. An experiment to evaluate the relative importance of several of the terms appearing in the theoretical formulation describing combustion noise sources has been developed. GRA

N76-19156# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
DUCT FLOW ANALYSIS METHODS FOR V/STOL PROPULSION SYSTEM APPLICATIONS Interim Report, 1 Jul. - 30 Sep. 1974
George K. Serovy and Patrick Kavanagh Dec. 1974 24 p refs
(Contract N00019-74-C-0401)
(AD-A016017; ISU-ERI-AMES-74253; TCRL-3) Avail: NTIS CSCL 20/4

In this interim report a selected bibliography of recent journal articles concerned with V/STOL lift/thrust vectoring/propulsion systems and with potentially attractive internal flow field computation systems is presented and discussed. Many of the flow configurations associated with V/STOL propulsion are so complex, involving asymmetric cross-sections, severe bends, offset sections, diverters, bleeds, etc., that an investigation of the real role of computational fluid dynamics in design and analysis is indicated. A specific goal should be to gain a clear understanding of the current and potential capabilities of candidate flow passage computational methods so that illusions can be destroyed and emphasis can be placed on the methods which can make a contribution now or at a predictable future time.
GRA

N76-19157# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
DUCT FLOW ANALYSIS METHODS FOR V/STOL PROPULSION SYSTEM APPLICATION Final Report
George K. Serovy and Patrick Kavanagh Apr. 1975 35 p refs
(Contract N00019-74-C-0401)
(AD-A015725; ISU-ERI-AMES-75085; TCRL-4) Avail: NTIS CSCL 20/4

This investigation was concerned with aerodynamic analysis methods for non-rotating elements of the flow path in lift/thrust-vectoring/propulsion systems for V/STOL aircraft. The character of the flows which occur in these systems in current and projected V/STOL aircraft was examined, and a broad spectrum of design methods was considered. These ranged from simple, one-dimensional calculations with high empirical content to recently developed internal turbulent flow field computational models. Special emphasis was placed on evaluation of the status of the more advanced computational methods, so that realistic objectives might be established for planning future programs. The most difficult of the presently unresolved problems in adaptation of internal flow computation models to general flow passage analysis appear to lie in the development of turbulence models and in the complex nature of real duct geometry. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-19158*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
THE INVESTIGATION OF OPTIMAL DISCRETE APPROXIMATIONS FOR REAL TIME FLIGHT SIMULATIONS Final Technical Report
E. A. Parrish, E. S. McVey, G. Cook, and K. Henderson Mar. 1976 80 p refs
(Grant NsG-1151)
(NASA-CR-146511; EE-4041-102-76) Avail: NTIS HC $5.00 CSCL 01C

The results are presented of an investigation of discrete approximations for real time flight simulation. Major topics discussed include: (1) consideration of the particular problem of approximation of continuous autopilots by digital autopilots; (2) use of Bode plots and synthesis of transfer functions by asymptotic fits in a warped frequency domain; (3) an investigation of the various substitution formulas, including the effects of nonlinearities; (4) use of pade approximation to the solution of the matrix exponential arising from the discrete state equations; and (5) an analytical integration of the state equation using interpolated input. Author

N76-19159*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[TRANSONIC AND SUPERSONIC AIRCRAFT WHEREIN THE PROBLEMS OF ROLL CONTROL AT HIGH ANGLES OF ATTACK ARE MINIMIZED] Patent Application
John G. Lamar, inventor (to NASA) Filed 21 Jan. 1976 11 p
(NASA-Case-LAR-11868-1; US-Patent-Appl-SN-651002) Avail: NTIS HC $3.50 CSCL 01C

A wing, for aircraft of cropped arrow-type planform with thin leading and side edges, with a pivotable tip to alter the crop angle of the wing during flight is examined. Increasing the crop angle causes the wing side edge to become a trailing edge thereby reducing the wing surface area which the leading edge and side edge shed vortex systems can act against. This reduction also diminishes the strength of the shed vortex system; decreasing the crop angle cause opposite results. The wing constitutes a roll control device for aircraft of the stated design and is particularly effective at higher angles of attack. NASA

N76-19160# National Aerospace Lab., Amsterdam (Netherlands).
HANDLING QUALITY CRITERIA DEVELOPMENT FOR TRANSPORT AIRCRAFT WITH FLY-BY-WIRE PRIMARY FLIGHT CONTROL SYSTEMS
H. A. Mooij Sep. 1974 19 p refs Presented at the AGARD Symp. on Impact of Active Control Technol. on Airplane Design, Paris, 14-17 Oct. 1974
(NLR-MP-74022-U) Avail: NTIS HC $3.50

Handling quality criteria based on parameters describing the combination of future transport aircraft and its closed loop flight control system were studied. Approach flight simulation and compensatory tracking, performed on a three degrees of freedom flight simulator as applied to a conceptual jet transport developed around the relaxed static stability concept is described. The stiffness of the pitch attitude system and the effectiveness of the direct-lift-control-system were varied. The following topics are discussed: required direct lift control effectiveness for an aircraft with a very low value of the normal acceleration sensitivity, required bandwidth of the pitch attitude control system for an aircraft with a value of the normal acceleration sensitivity typical for the present-day jumbo aircraft, pilot opinion on the absence of a stable stick force/(deflection) versus airspeed gradient for pitch-stabilized aircraft, and results of compensatory tracking experiments. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N76-19161 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ALL DIGITAL SIMULATION FOR MANNED FLIGHT IN TURBULENCE Ph.D. Thesis
Joseph John Pollard 1975 190 p
Avail: Univ. Microfilms Order No. 76-6500

The six-degree-of-freedom constant coefficient linearized perturbation equations of motion are developed for use in conjunction with a generalized stability augmentation system; the six-degree-of-freedom turbulence environment is implemented by solving stochastic linear differential equations. A pilot consisting of two parts: (1) a decision making data processor and (2) a physical implementation of the required control action is developed and concepts such as urgency for action, instrumentation thresholds, pure pilot delay, pilot prediction, pilot lag, and pilot motor noise are treated. The resulting all digital closed loop multi-axis, multi-input, multi-output system is applied to aircraft of various classes including the F-5, A-7, 707, and T-33. Results are presented in tabular and graphical form with statistical tests run to show simulation validity and comparability with actual man-in-the-loop simulations. Additional applications of the digital simulator are made showing its usefulness in the overall concept of aircraft simulation. Dissert. Abstr.

N76-19162*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHAKE TEST OF A PROPELLER TEST RIG IN THE 40- BY 80-FOOT WIND TUNNEL
Wayne Johnson Nov. 1975 24 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(NASA-TM-X-62506; A-6368) Avail: NTIS HC $3.50 CSCL 14B

A shake test was conducted to determine the dynamic characteristics of a propeller test rig in the Ames 40- by 80-Foot Wind Tunnel. The rotor off hub transfer function (acceleration per unit force as a function of frequency) was measured in the longitudinal, lateral, and vertical directions for shaft angles of 0 and 90 deg corresponding to propeller and helicopter operation, respectively. The dynamic data are summarized for the configurations tested, giving the following properties for each mode identified: the natural frequency, the hub response at resonance, the damping coefficient, the damping ratio, and the modal mass. The complete transfer functions are presented, and the detailed test results are included. Author

N76-19163*# Kanner (Leo) Associates, Redwood City, Calif.
THE OPTIMIZATION OF WIND TUNNEL CONTRACTIONS FOR THE SUBSONIC RANGE Ph.D. Thesis
G. G. Borger Washington NASA Mar. 1976 145 p refs Transl. into ENGLISH of "Optimierung von Windkanalduesen fur den Unterschallbereich" Bochum, West Germany, Ruhr-Universitat, 1973 p 1-151
(Contract NASw-2790)
(NASA-TT-F-16899) Avail: NTIS HC $6.00 CSCL 14B

The development of optimal contours for two dimensional and axisymmetric subsonic wind tunnel contractions is considered. A description is given of a method for the calculation of frictionless flows in the case of two dimensional and axisymmetric ducts of arbitrary contraction or extension characteristics. FORTRAN 4 programs have been developed for the numerical computations involved. A method reported by Bradshaw et al. is used for the boundary layer calculations. The developed mathematical procedures are employed to optimize the design of the wind tunnel contractions. Author

N76-19164# Royal Aircraft Establishment, Farnborough (England).

CONTRIBUTION TO THE STUDY OF ACOUSTIC AIR-JET GENERATORS
E. Brocher Sep. 1975 21 p refs Transl. into ENGLISH from Acustica (West Germany), v. 32, no. 4, 1975 p 227-235
(RAE-Lib-Trans-1862; BR49565) Avail: NTIS HC $3.50

The operation of acoustic air-jet generators is explained outside the region or in the absence of the Hartmann instability intervals, through the periodical boundary layer separation developed on objects placed in the air-jet. A new type of generator, working in these conditions, the 'needle' generator is described. It is experimentally shown that its characteristics are great emission stability, high acoustical efficiency (up to 16%), and a purity of the emitted sound which can be as high as 99%. Author

N76-19165# Airborne Instruments Lab., Farmingdale, N.Y.
AUTOMATIC TRACKING FACILITY Interim Report, Sep. 1973 - Jun. 1975
Albert S. Palatnick Jul. 1975 31 p
(Contract DOT-FA74WA-3345)
(AD-A018367/3; FGS-A414-3; FAA-RD-75-203) Avail: NTIS HC $4.00 CSCL 01/2

The design is described of the automatic tracking and control system that will be used with a glide slope and localizer scale model instrument landing system facilities. The design approach uses a positive drive system to control trolly height as a function of carriage displacement from threshold and glide path angle. A carriage and mast assembly simulating an aircraft on its final approach was designed and built. A digital servo system for the accurate positioning of the simulated aircraft receiving antenna was developed. Author

N76-19166# Airborne Instruments Lab., Farmingdale, N.Y.
SCALE MODEL GLIDE SLOPE FACILITY Interim Report, Sep. 1973 - Jun. 1975
Neil J. Creedon Jul. 1975 21 p
(Contract DOT-FA74WA-3345)
(AD-A018436; FGS-A414-1; FAA-RD-75-202) Avail: NTIS HC $3.50 CSCL 17/7

The fabrication of a 1/30 scale model glide slope system is described. The process used to achieve the required amplitude modulation of a 9 GHz carrier is detailed. Author

N76-19167# Texas Instruments, Inc., Dallas.
INSTRUMENT LANDING SYSTEM CATEGORY 3 Final Report, Jul. 1971 - Nov. 1974
Ronald Fossier Dec. 1974 140 p
(Contract DOT-FA71WA-2635)
(AD-A018320; FAA-RD-74-180) Avail: NTIS HC $6.00 CSCL 17/7

Category III ILS systems (designated FAA Mark-III ILS) featuring wide aperture parabolic localizer antennas were developed. Significant system requirements and a general description of system design are presented. Results of design studies, testing, installation, and field evaluation are furnished with a description of problems encountered and corrective action taken. Author

N76-19168# National Aerospace Lab., Amsterdam (Netherlands).
RESEARCH ON STRUCTURES AND MATERIALS
1974 17 p
Avail: NTIS HC $3.50

Structure and materials research activities are described together with equipment and data processing methods developed. The analysis of loads on aircraft, fatigue load monitoring in service, flight simulation fatigue tests, and failure analysis are discussed. Strength of cracked structures, nonlinear stability, stress corrosion, and fractography studies were performed. Materials research was pursued on titanium and advanced aluminum alloys, composite structures, and adhesively bonded joints. ESA

N76-19169# Systems Research Labs., Inc., Dayton, Ohio.
FUNCTIONAL INTEGRATED SYSTEMS TRAINER: TECHNICAL DESIGN AND OPERATION Final Report, 1 Jun. 1973 - 15 Dec. 1974
Bertram W. Cream and David C. Lambertson Brooks, AFB, Tex. AFHRL Jun. 1975 60 p
(Contract F33615-73-C-4134)
(AD-A015835; AFHRL-TR-75-6(2)) Avail: NTIS CSCL 05/9

A functional integrated systems trainer was designed and constructed for training four members of the Gunship AC -130 E/H crew in their individual and crew coordination tasks. The design was based on the behavioral task analysis conducted by the Tactical Air Command (TAC) instructional systems development team and further refined by Air Force Human Resources Laboratory. The trainer is installed and currently being used by TAC. An extensive evaluation was conducted which focused on the actual training value of the device. The findings showed that it provided effective training, validated the design concepts/techniques, and the cost effectiveness of functional, low cost part task trainers. It also provided significant additional information pertaining to the design and utilization of such devices and their applications to other systems. The construction and operation of the device are described. GRA

N76-19170# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATHEMATICAL MODEL OF AN AIR CUSHION VEHICLE Final Report, 8 Jun. 1973 - 8 Nov. 1974
Damon Cummings, Edward Kern, Stanley Shursky, and Ronald Yeung May 1975 136 p refs
(Contract N61339-73-C-0138; AF Proj. 3741)
(AD-A015699; NAVTRAEQUIPC-73-C-0138-1) Avail: NTIS CSCL 05/9

This report describes the development of a mathematical model of the Bell Aerospace Air Cushion Vehicle Landing Craft (JEFF-B). The model is intended for use in a real time hands on pilot training simulator. Equations of motion, cushion dynamics, control and machinery dynamics and water wave effects are modeled. GRA

N76-19171# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WIND TUNNEL DATA ACQUISITION PROCEDURES Final Report
Lyle D. Kayser Aug. 1975 30 p refs
(DA Proj. 1T6-62618-AH-80)
(AD-A016115; BRL-MR-2515) Avail: NTIS CSCL 14/2

The procedures for acquiring data with the Astrodata system are explained in this report. These procedures are compatible with the standard wind tunnel data reduction program. Also included is a brief generalized description of the data acquisition system functions and some examples of unprocessed data which should help to clarify the procedures. This report is intended to aid operational personnel, program engineers, and users of the wind tunnel in obtaining data in an orderly and efficient manner. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-19172*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE 9TH AEROSPACE MECHANISMS SYMPOSIUM
Washinton Aug. 1975 388 p refs Symp. held at Cocoa Beach, Fla., 17-18 Oct. 1974
(NASA-TM-X-3274) Avail: NTIS HC $10.75 CSCL 22A

Papers are presented dealing with performance and development of various spacecraft components, mechanical devices, and subsystems. Topics discussed include: manipulator arms, the Skylab Parasol, cooling system performance, extendable booms, magnetically suspended reaction wheels, the Skylab Trash Airlock, magnetometers, actuators, life support systems, and technology transfer. For individual titles, see N76-19173 through N76-19198.

N76-19173* General Dynamics/Convair, San Diego, Calif.
FORWARD BEARING REACTOR MECHANISM FOR TITAN 3-E/CENTAUR D-1T SPACE LAUNCH VEHICLE c15
Richard A. Jones *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 1-18 (For availability see N76-19172 10-12)
CSCL 22D

System between the Titan/Centaur launch vehicle and its aerodynamic shroud is described. The system provides a precise spring constant and is capable of being inactivated during flight. Design requirements, design details, and the test program are discussed. The conventional English system of units was used during this development program for all principal measurements and calculations. Author

N76-19174* Martin Marietta Corp., Denver, Colo.
A MANIPULATOR ARM FOR ZERO-g SIMULATIONS c54
Shepard B. Brodie, Christopher Grant, and Janos J. Lazar *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 19-29 (For availability see N76-19172 10-12)
CSCL 05H

A 12-ft counterbalanced Slave Manipulator Arm (SMA) was designed and fabricated to be used for resolving the questions of operational applications, capabilities, and limitations for such remote manned systems as the Payload Deployment and Retrieval Mechanism (PDRM) for the shuttle, the Free-Flying Teleoperator System, the Advanced Space Tug, and Planetary Rovers. As a developmental tool for the shuttle manipulator system (or PDRM), the SMA represents an approximate one-quarter scale working model for simulating and demonstrating payload handling, docking assistance, and satellite servicing. For the Free-Flying Teleoperator System and the Advanced Tug, the SMA provides a near full-scale developmental tool for satellite servicing, docking, and deployment/retrieval procedures, techniques, and support equipment requirements. For the Planetary Rovers, it provides an oversize developmental tool for sample handling and soil mechanics investigations. The design of the SMA was based on concepts developed for a 40-ft NASA technology arm to be used for zero-g shuttle manipulator simulations. Author

N76-19175* Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL EVALUATION OF DEPLOYABLE AERODYNAMIC SPIKE BOOMS c19
B. J. Richter *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 31-43 ref (For availability see N76-19172 10-12)
CSCL 14B

An extendable boom consisting of a series of telescopic cylindrical tube segments and overlapping lock joints developed for use as an aerodynamic spike mounted atop a missile is described. Two candidate design concepts differing mainly in the particular overlapping lock joint designs are undergoing a combined analytical/experimental evaluation. Some of the results of this evaluation are presented. Author

N76-19176* Ball Bros. Research Corp., Boulder, Colo.
AEROSPACE LUBRICATION TECHNOLOGY TRANSFER TO INDUSTRIAL APPLICATIONS c37
Thomas J. Loran and Bill Perrin *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 45-57 (For availability see N76-19172 10-12)
CSCL 11H

Difficulties encountered in entering industrial markets with an aerospace lubrication and coating technology are discussed along with the technical, financial, and managerial solutions that evolved. Author

N76-19177* TRW Systems Group, Redondo Beach, Calif.
A STRUT WITH INFINITELY ADJUSTABLE THERMAL EXPANSIVITY AND LENGTH c37
Paul T. Nelson *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 59-67 (For availability see N76-19172 10-12)
CSCL 20K

A tubular strut with an integral mechanism for adjusting its thermal expansivity and length was developed to fulfill the stringent thermal stability requirements anticipated for the metering truss in the Large Space Telescope. Its features may be advantageously applied to a general variety of structures and precision mechanisms where dimensional control of component elements in a dynamic thermal environment is required. Detail, design, fabrication, and test of a developmental strut are discussed. Author

N76-19178* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT FRICTION AND WEAR MECHANISM c37
E. J. Devine and H. E. Evans *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 69-79 refs (For availability see N76-19172 10-12)
CSCL 14B

A unique mechanism developed for conducting friction and wear experiments in orbit is described. The device is capable of testing twelve material samples simultaneously. Parameters considered critical include: power, weight, volume, mounting, cleanliness, and thermal designs. The device performed flawlessly in orbit over an eighteen month period and demonstrated the usefulness of this design for future unmanned spacecraft or shuttle applications. Author

N76-19179* Fairchild Space and Electronics Co., Germantown, Md.
METAL WITH A MEMORY PROVIDES USEFUL TOOL FOR SKYLAB ASTRONAUTS c37
G. A. Smith *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 81-97 (For availability see N76-19172 10-12)
CSCL 14B

Extendible booms used to convey film cassettes weighing 56.7 kg (125 lb) between the Airlock Module and the Apollo Telescope Mount are described along with the dispensing mechanism. Problems encountered with the mechanism during the test program are discussed. These problems were mainly associated with operation in cold temperature, lubrication, and the motor/gearhead assembly. Another set of problems which arose during crew training in the MSFC water tank is also discussed. Author

N76-19180* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB PARASOL c18
Jack A. Kinzler *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 99-113 (For availability see N76-19172 10-12)
CSCL 22B

An alternate thermal protection system for the Skylab space station cluster was deemed necessary shortly after launch when severe damage occured to the orbital workshop as it passed through the period of maximum dynamic pressure. Data indicated that the combination micrometeoroid and thermal shield on the sun facing side of the vehicle had been destroyed. The simultaneous design, fabrication, and test of the Skylab Parasol System which was completed in 6 days of around-the-clock effort is described. The Skylab Parasol design was selected as the primary sunshade device based on simplicity of design, ability to fabricate quickly, and early demonstration of a working prototype which featured semiautomatic deployment from within the workshop under shirt sleeve environment conditions. Author

N76-19181* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE PERFORMANCE OF COMPONENTS IN THE SKYLAB REFRIGERATION SYSTEM c54
Charles E. Daniher, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 115-131 refs (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 06K

The on-orbit performance of the Skylab refrigeration system components is presented. Flight anomalies are analyzed and performance of the newly developed components is described. Nine months of orbit data proved the practicality of the leak-free coolant system design. Flight proven application of a thermal capacitor and development test results of the first all-mechanical, low temperature mixing valve represent a significant advance in single-phase, low temperature coolant loop design. System flight data suggest that additional instrumentation and fluid filters could have prevented system orbit performance anomalies. Author

N76-19182* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REFURBISHMENT OF THE CRYOGENIC COOLERS FOR THE

SKYLAB EARTH RESOURCES EXPERIMENT PACKAGE **c19**

Jerry C. Smithson and Norman C. Luksa *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 133-148 ref (For availability see N76-19172 10-12)
CSCL 14B

Skylab Earth Resources Experiment Package (EREP) experiments, S191 and S192, required a cold temperature reference for operation of a spectrometer. This cold temperature reference was provided by a subminiature Stirling cycle cooler. However, the failure of the cooler to pass the qualification test made it necessary for additional cooler development, refurbishment, and qualification. A description of the failures and the cause of these failures for each of the coolers is presented. The solutions to the various failure modes are discussed along with problems which arose during the refurbishment program. The rationale and results of various tests are presented. The successful completion of the cryogenic cooler refurbishment program resulted in four of these coolers being flown on Skylab. The system operation during the flight is presented. Author

N76-19183* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SKYLAB TRASH AIRLOCK **c54**

Larry R. Price *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 149-159 (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 06K

The Skylab Trash Airlock (TAL) used throughout the Skylab mission to transfer trash materials that could support microbial growth from the pressurized cabin to the unpressurized waste tank is described. The TAL, which uses several basic mechanisms, was successfully operated daily for the 170 days of manned missions for a total of 637 cycles. Author

N76-19184* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRECISION SIX-METER DEPLOYABLE BOOM FOR THE MARINER-VENUS-MERCURY 1973 MAGNETOMETER EXPERIMENT **c37**

Harry F. Burdick *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 161-174 refs (For availability see N76-19172 10-12)
CSCL 14B

A unique deployable boom developed for accurately positioning magnetometers 6 meters (19.7 feet) from a spacecraft is described. Weight, mounting system, magnetic cleanliness, thermal dimensional stability, and natural frequency were critical constraints that were met. The boom was flown on Mariner 10 and deployed flawlessly. The design, development, and testing of the boom and optical alignment of the sensors are described. Design trades and problem solutions are discussed. Author

N76-19185* Chrysler Corp., Detroit, Mich. Defense Div.
DISPERSION DEVELOPMENT PROGRAM **c99**

D. J. Carlson, R. J. Lusardi, and W. H. Phillips *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 175-186 (For availability see N76-19172 10-12)
(Contract DAAA21-72-C-0030)
CSCL 16C

The requirement for the predictable dispersion of small munitions over large areas from ground support missile systems has resulted in the development of a fin stabilized submissile and sling ejection system for the Little John warhead. The progressive development of this system is traced including a comparison of simulator, sled test, and flight test results. The results indicate that it is not only necessary but also possible to eject long slender bodies, from a missile warhead at Mach 1, in a stable, uniform and predictable manner. Author

N76-19186* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW CONCEPT FOR ACTUATING SPACE MECHANISMS **c37**

William C. Stange *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 187-197 ref (For availability see N76-19172 10-12)
CSCL 14B

A two position (0 and 180 deg) actuating mechanism driven by two alternately heated opposing flat NITINOL springs is proposed for rotating the low field triaxial fluxgate magnetometer experiment on the 1977 Mariner Jupiter-Saturn spacecraft to its 0 deg and 180 deg positions. The magnetic field, power requirements, weight, and volume of this device are very restrictive. The problems encountered in design and development are presented. Author

N76-19187* Santa Barbara Research Center, Goleta, Calif.
THE MECHANICAL DESIGN OF AN IMAGING PHOTOPOLARIMETER FOR THE JUPITER MISSIONS (PIONEER 10 AND 11) **c19**

James C. Kodak *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 199-209 (For availability see N76-19172 10-12)
(Contract NAS2-5605)
CSCL 14B

The mechanical design and fabrication are discussed of the imaging photopolarimeter (IPP), a multifunction space-qualified instrument used on the Jupiter Pioneer missions. The extreme environmental requirements for the structural design, optical system, and mechanisms are described with detailed discussion of some of the design and fabrication problems encountered. Author

N76-19188* Sperry Flight Systems, Phoenix, Ariz.
MAGNETICALLY SUSPENDED REACTION WHEELS **c18**

Ajit V. Sabnis, George L. Stocking, and Joe B. Dendy *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 211-234 refs Prepared for JPL (For availability see N76-19172 10-12)
(Contract NAS7-100)
CSCL 22B

Magnetic suspensions offer several advantages over conventional bearings, arising because of the contactless nature of the load support. In application to spacecraft reaction wheels, the advantages are low drag torque, wearfree, unlubricated, vacuum-compatible operation, and unlimited life. By the provision of redundancy in the control electronics, single-point failures are eliminated. The rational for selection of a passive radial, active axial, dc magnetic suspension is presented, and the relative merits of 3-loop and single-loop magnetic suspensions are discussed. The design of a .678 N-m-sec (.5 ft-lb-sec) reaction wheel using the single loop magnetic suspension was developed; the design compares favorably with current ball bearing wheels in terms of weight and power. Author

N76-19189* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Propulsion/Mechanical Dept.
USE OF COMPUTER MODELING TO INVESTIGATE A DYNAMIC INTERACTION PROBLEM IN THE SKYLAB TACS QUAD-VALVE PACKAGE **c18**

Raymond J. Hesser and Robert Gershman *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 235-246 refs (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 22B

A valve opening-response problem encountered during development of a control valve for the Skylab thruster attitude control system (TACS) is described. The problem involved effects of dynamic interaction among valves in the quad-redundant valve package. Also described is a detailed computer simulation of the quad-valve package which was helpful in resolving the problem. Author

N76-19190* Rensselaer Polytechnic Inst., Troy, N.Y.
MODERN MECHANISMS MAKE MANLESS MARTIAN MISSION MOBILE: SPIN-OFF SPELLS STAIRCLIMBING SELF-SUFFICIENCY FOR EARTHBOUND HANDICAPPED **c54**

George N. Sandor, David R. Hassel, and Philip F. Marino *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 247-263 refs (For availability see N76-19172 10-12)
(Grant NGL-33-018-091)
CSCL 05H

Concepts were developed for three wheel chairs from progressively improving designs of a proposed unmanned roving

vehicle for the surface exploration of Mars; as a spin-off, a concept for a stair-climbing wheel chair was generated. The mechanisms employed in these are described. The Mars mission is envisioned using the booster rockets and aeroshell of the Viking missions. Author

N76-19191* Lockheed Missiles and Space Co., Sunnyvale, Calif.
LOADCELL SUPPORTS FOR A DYNAMIC FORCE PLATE **c39**
C. W. Keller, L. M. Musil, and John L. Hagy (Shriners Hospital for Crippled Children) *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 265-280 refs (For availability see N76-19172 10-12)
CSCL 20K

An apparatus was developed to accurately measure components of force along three mutually perpendicular axes, torque, and the center of pressure imposed by the foot of a subject walking over its surface. The data obtained were used to supplement high-speed motion picture and electromyographic (EMG) data for in-depth studies of normal or abnormal human gait. Significant features of the design (in particular, the mechanisms used to support the loadcell transducers) are described. Results of the development program and typical data obtained with the device are presented and discussed. Author

N76-19192* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT OF A BONE-FIXATION PROSTHETIC ATTACHMENT **c52**
Lester J. Owens *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 281-293 (For availability see N76-19172 10-12)
CSCL 06B

An artificial limb attached directly to the bone by a quick-disconnect coupling was tested in-place at a California medical rehabilitation center. Its design concept and development, made possible by multiple spinoffs of aerospace technology, are discussed. Author

N76-19193* Rockwell International Corp., Downey, Calif.
A UNIQUE CHALLENGE: EMERGENCY EGRESS AND LIFE SUPPORT EQUIPMENT AT KSC **c54**
Henry M. Waddell, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 295-312 (For availability see N76-19172 10-12)
CSCL 06K

As a result of the investigation following the January 1967 fire, which took the lives of three astronauts, materials were developed, flight hardware was modified, and test procedures were rewritten in order to establish the framework within which a more effective rescue concept could be developed. Topics discussed include breathing units, improved life support equipment, miniresuscitators, and hazardous tasks during space shuttle launch and landing operations. Author

N76-19194* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
A DAMPER FOR GROUND WIND-INDUCED LAUNCH VEHICLE OSCILLATIONS **c14**
John G. Bodle and David S. Hackley *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 313-334 (For availability see N76-19172 10-12)
CSCL 22D

Prelaunch oscillatory bending deflections of the Atlas/Centaur launch vehicle are restrained by a damper mechanism mounted on the end of a horizontal boom supported from the umbilical tower. A single vertical pin on the vehicle engages the mechanism, and the damper is connected to the vehicle until liftoff. As the attach pin rises with the vehicle, a retractable arm mechanism provides initial clearance. An explosive release mechanism allows the boom to swing clear of the vehicle like a pendulum, while a snubber mechanism decelerates the free swinging boom and damper mechanism to a safe stop. Author

N76-19195* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HOLDDOWN ARM RELEASE MECHANISM USED ON SATURN VEHICLES **c14**
J. D. Phillips and B. A. Tolson *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 335-357 (For availability see N76-19172 10-12)
CSCL 22D

With the development of the Saturn launch vehicle, it became mandatory to develop a system for restraining the vehicle until after all checks and engine thrust buildup were completed. The basic Saturn I holddown arm constrains the vehicle by clamping it between a fixed support and a movable jaw. The jaw is on a link pinned to rotate sufficiently to release the vehicle. There are three links in the jaw (restraining) system arranged so that with a small force provided by a pneumatic separator mechanism, the large loads of the vehicle can be restrained. Design details discussed are the link system, the separator, adjustments, and the energy absorber. The function of preloading is discussed. The secondary release system is described. Finally, the design differences between the Saturn I and the Saturn V arm are described. Author

N76-19196* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CRAWLER TRANSPORTER STEERING AND JEL SYSTEMS **c14**
Virgil Leon Davis *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 359-372 (For availability see N76-19172 10-12)
CSCL 22D

The transporter weighing 2.8 million kilograms (6.3 million pounds) was used to lift a 5.7-million-kilogram (12.6-million-pound) combination of mobile launcher and space vehicle, transfer this load approximately 5.6 kilometers (3.5 miles) from its point of assembly, negotiate curves of 152-meter (500-foot) mean radius, climb a 5-percent grade while maintaining the 122-meter (400-foot) structure in a vertical position within 10 minutes of arc, and smoothly position this huge structure to within plus or minus 5.1 centimeters (plus or minus 2 inches) on support pedestals at the launch pad. The crawler-transporter is described in detail. Author

N76-19197* Balke (Harry A.) Engineers, Cincinnati, Ohio.
MOUNT MECHANISMS FOR THE SATURN 5/APOLLO MOBILE LAUNCHER AT JOHN F. KENNEDY SPACE CENTER **c14**
Harry A. Balke *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 373-386 (For availability see N76-19172 10-12)
CSCL 22D

A support system was designed to resist hurricane wind loads at the launch pad and to allow the supported structural frame to expand and contract freely under wide ranges of temperature. This system consists of six mount mechanisms devised to meet the previously stated requirements plus a load-carrying capacity for each of 3.2-million kilograms (7-million pounds) downward and 1.6-million kilograms (3.5-million pounds) upward. A similar but lighter system of six mount mechanisms was designed for use in the sheltered environment of the vehicle assembly building. Each requirement and design result is discussed, and each mount mechanism is defined by location and type with references to visual presentations. Author

N76-19198* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Design Section.
AUTOMATED PARKING GARAGE SYSTEM MODEL **c85**
Earl R. Collins, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 387-394 (For availability see N76-19172 10-12)
(Contract NAS7-100)
CSCL 13B

A one-twenty-fifth scale model of the key components of an automated parking garage system is described. The design of the model required transferring a vehicle from an entry level, vertically (+Z, -Z), to a storage location at any one of four storage positions (+X, -X, +Y, +Y, -Y) on the storage levels. There are three primary subsystems: (1) a screw jack to provide the vertical motion of the elevator, (2) a cam-driven track-switching device to provide X to Y motion, and (3) a transfer cart to provide horizontal travel and a small amount to vertical motion for transfer to the storage location. Motive power is provided by dc permanent magnet gear motors, one each for

the elevator and track switching device and two for the transfer cart drive system (one driving the cart horizontally and the other providing the vertical transfer). The control system, through the use of a microprocessor, provides complete automation through a feedback system which utilizes sensing devices.
Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-19199*# Boeing Co., Huntsville, Ala. Space Div.
APOLLO/SATURN 5 POSTFLIGHT TRAJECTORY: AS-512
G. T. Pinson 11 Apr. 1973 237 p refs
(Contract NAS8-5608)
(NASA-CR-144080; D5-15560-12) Avail: NTIS HC$8.00 CSCL 22C

The postflight trajectory is presented for the Apollo/Saturn V AS-512 flight. An analysis is included of the orbital and powered flight trajectories of the launch vehicle and the free flight trajectories of the expended S-IC and S-II stages. Trajectory dependent parameters are provided in earth-fixed launch site, launch vehicle navigation, and geographic polar coordinate systems. The time history of the trajectory parameters for the launch vehicle is presented from guidance reference release to Command Service Module (CSM) separation. Tables of significant parameters at engine cutoff, stage separation, parking orbit insertion, and translunar injection are included. Figures of such parameters as altitude, surface and cross range, and the magnitude of total velocity and acceleration as a function of range time for the powered flight trajectories are presented. Author

N76-19200*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF AN OPTIMAL PROGRAM OF TRAJECTORY MEASUREMENTS WITH CORRELATED ERRORS
V. B. Britkov Washington NASA Jan. 1976 24 p refs Transl. into ENGLISH from Inst. of Appl. Math., Acad. of Sci. USSR, Preprint no. 67, 1975 p 1-30
(Contract NASw-2791)
(NASA-TT-F-16831) Avail: NTIS HC $3.50 CSCL 22A

An investigation is made of the problem of finding optimal times of measurements with correlated errors. The structure of the covariant measurement error matrix is assumed known. A combination of methods is proposed that permit the solution of the problem. An optimal program of measurements is given for the case of a determination of the orbit of an artificial Mars satellite for various correlation coefficients. The effect of correlation on the accuracy of the determination of trajectory parameters is studied. Author

N76-19201*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ON THE STABILITY OF PERIODIC MOTIONS OF AN ASSYMETRICAL SATELLITE IN A CIRCULAR ORBIT
A. P. Markeyev Washington NASA Feb. 1976 51 p refs Transl. into ENGLISH from "Ob Ustoychivosti Periodicheskikh Dvizheniy Nesimmetrichnogo Sputnika na Krugovom Orbite" Moscow, Acad. of Sci. of the USSR, preprint no. 58, 1975 p 1-62
(Contract NASw-2789)
(NASA-TT-F-16828; Preprint-58) Avail: NTIS HC $4.50 CSCL 22C

The stability of the periodic motions of an artificial satellite is studied relative to the center of mass in a central Newtonian gravitational field. The satellite is a solid body with three unequal moments of inertia. The orbit of the center of mass is circular. For the periodic motions studied, one of the axes of the ellipsoid of inertia is directed along the normal to the plane of orbit during the entire motion; whereas to two others cause vibrations of random amplitude or rotate at a random angular velocity within the orbital plane. The problem is solved in a nonlinear form. An analytical study was conducted through various means of introducing a small parameter. Author

N76-19113* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIMES FOR INTERPLANETARY TRIPS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 923-925 (For availability see N76-19059 10-02)
CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-19194* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
A DAMPER FOR GROUND WIND-INDUCED LAUNCH VEHICLE OSCILLATIONS
John G. Bodle and David S. Hackley *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 313-334 (For availability see N76-19172 10-12)
CSCL 22D

N76-19195* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HOLDDOWN ARM RELEASE MECHANISM USED ON SATURN VEHICLES
J. D. Phillips and B. A. Tolson *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 335-357 (For availability see N76-19172 10-12)
CSCL 22D

N76-19196* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CRAWLER TRANSPORTER STEERING AND JEL SYSTEMS
Virgil Leon Davis *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 359-372 (For availability see N76-19172 10-12)
CSCL 22D

N76-19197* Balke (Harry A.) Engineers, Cincinnati, Ohio.
MOUNT MECHANISMS FOR THE SATURN 5/APOLLO MOBILE LAUNCHER AT JOHN F. KENNEDY SPACE CENTER
Harry A. Balke *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 373-386 (For availability see N76-19172 10-12)
CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-19202*# National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH SECOND SATCOM IN RCA SERIES
[1976] 21 p
(NASA-News-Release-76-37) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22D

The RCA-SATCOM-11 satellite, scheduled to be launched from Cape Canaveral, Fla. on March 25, 1976, using a Delta launch vehicle, was discussed. The following subjects were described: satellite itself, launch vehicle, launch operations, key personnel. Y.J.A.

N76-19203*# National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH THIRD NATO COMMUNICATIONS SATELLITE
[1976] 12 p

(NASA-News-Release-76-46) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22D

Launching of the third NATO communications satellite is discussed. The Delta launch vehicle is briefly described along with launch operations. Management of the Delta program is considered. J.M.S.

N76-19204 Stanford Univ., Calif.
ORIENTATION AND THREE-DIMENSIONAL MASS CENTER ESTIMATION IN A ROTATING DRAG-FREE SATELLITE Ph.D. Thesis
Segismundo Sanz Fernandez de Cordova 1975 213 p
Avail: Univ. Microfilms Order No. 76-5798

A drag free satellite is controlled in translation so that it follows a proof mass in an internal cavity. The proof mass is in a drag free orbit because the main satellite shields it from all external forces. When the satellite is spun about one axis so that the attraction forces it produces over the proof mass are averaged on the other two axes, the proof mass can be located, in general, on the spin axis, but possibly far away from the mass center. In that case, attitude motions of the satellite are sensed by the proof mass. This coupling of attitude and translation may lead to instability in the motion of the satellite when it is coupled with misalignments of the thrustors of the translation control system. The effect of the coupling between the attitude and translation controls is studied, and a boundary of stability is developed for the phenomenon. Dissert. Abstr.

N76-19205*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
INVESTIGATION OF ENVIRONMENTAL PERTURBATIONS ON PASSIVE ASYMMETRIC SATELLITE
Vincent Tate Apr. 1976 73 p refs
(Grants NGR-39-009-162; NsG-7078)
(NASA-CR-146507; RR-76-1) Avail: NTIS HC $4.50 CSCL 22C

The effects of environmental perturbations on the attitude of a slow tumbling earth-oriented satellite are investigated. The environmental perturbations considered were aerodynamic drag, gravity-gradient, solar radiation pressure, and magnetic torques. The Euler attitude equations were solved numerically for the Skylab spacecraft. Results are presented for both torque-free motion and for cases in which aerodynamic and gravity-gradient torques are acting in a slow tumble mode. Simulations show gravity-gradient effects on satellite momentum to be cyclic and to increase the precession rate of the angular momentum vector about the radius vector. This also tends to align the minor axis along the radius vector. Aerodynamic drag initially decreases angular momentum, slowly precesses the momentum vector about the radius vector, and finally drives the satellite into an unstable mode. Combined gravity-gradient and aerodynamic torques reduce angular momentum and energy, and induce a steady precession rate of the momentum vector about the radius vector. Author

N76-19206# Friedman (Morris D.), Inc., West Newton, Mass.
BOOSTER AIMING
V. Karin 1975 6 p Transl. into ENGLISH from Aviats. i Kosmonavt. (USSR), no. 10, 1975 p 38-39
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The process of pointing rockets is discussed for both the vertical and azimuth planes. The methods for adjusting and checking the gyroplatforms and coordinates in preparation for the booster launch are described including photochemical units, autocollimators, and polarization units. The sighting system is cotrolled by commands from following reflectors which provide a primary lockon signal. F.O.S.

N76-19207# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM - SATELLITE SUB-SYSTEM. INFORMATION ON METEOROLOGICAL SATELLITE PROGRAMMES OPERATED BY MEMBERS AND ORGANIZATIONS
1975 71 p
(WMO-411; ISBN-92-63-10411-5) Avail: NTIS HC $4.50; WMO, Geneva

Current information on the meteorological satellite program of the European Space Agency, Japan, U.S.S.R. and the U.S. is presented. Details include the satellite orbits, data collection and transmission specifications and sensory equipment. ESA

N76-19173* General Dynamics/Convair, San Diego, Calif.
FORWARD BEARING REACTOR MECHANISM FOR TITAN 3-E/CENTAUR D-1T SPACE LAUNCH VEHICLE
Richard A. Jones *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 1-18 (For availability see N76-19172 10-12)
CSCL 22D

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-19208*# General Electric Co., Schenectady, N.Y. Communications Lab.
ATS-5 TRILATERATION SUPPORT Final Report, 12 Nov. 1973 - 31 Dec. 1975
Axel F. Brisken and Roy E. Anderson 31 Dec. 1975 198 p refs
(Contract NAS5-20034)
(NASA-CR-144734; SRD-76-004) Avail: NTIS HC $7.50 CSCL 22D

The development of an L-band trilateration network capable of locating the ATS-5 satellite, determining the satellite's orbital elements, and predicting the satellite position was investigated. An automatic tone-code ranging transponder was used to compare ranging measurements and communications reliability for the VHF and L-band. The L-band transponder network, analytical techniques, and the determination of the Kepler orbit parameters are described along with the calibration procedures, operation procedures, and verification of trilateration position. F.O.S.

N76-19209*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SPACE SHUTTLE ORBITAL MANEUVERING SYSTEM FAILURE DETECTION AND IDENTIFICATION SOFTWARE REQUIREMENTS (UNCONTROLLED)
Louis A. DAmario and John P. Vullo Jan. 1976 65 p refs
(Contract NAS9-13809)
(NASA-CR-147493; R-932) Avail: NTIS HC $4.50 CSCL 22B

Candidate designs and their software implementation are presented for the Orbital Maneuvering System (OMS) Failure Detection and Identification (FDI) algorithms in the Redundance Management (RM) module of the Space Shuttle Guidance, Navigation, and Control (GN&C) software. The OMS engine FDI algorithm monitors OMS engine thrust performance, and the OMS actuator FDI algorithm monitors OMS gimbal actuator performance. The software functional requirements of the

algorithms are described along with the objective of each algorithm. A list of the assumptions which have governed its design, input/output requirements, a functional description of the algorithm (including a functional block diagram), and input interface requirements are given. The HAL (the language of the space shuttle flight computer) software formulation of the algorithms is considered including structured flowcharts of the procedures, estimates of flight computer core storage and CPU time, and processing requirements. A glossary of the symbols used to define the software requirements and formulations is included. Author

N76-19210*# McDonnell-Douglas Corp., St. Louis, Mo.
LASER DATA TRANSFER FLIGHT EXPERIMENT DEFINITION Final Report
J. R. Merritt Dec. 1975 95 p
(Contract NAS5-20585)
(NASA-CR-144738) Avail: NTIS HC $5.00 CSCL 17B

A set of laser communication flight experiments to be performed between a relay satellite, ground terminals, and space shuttles were synthesized and evaluated. Results include a definition of the space terminals, NASA ground terminals, test methods, and test schedules required to perform the experiments. Author

N76-19211*# Ohio State Univ., Columbus. ElectroScience Lab.
ATS-6 MILLIMETER WAVELENGTH PROPAGATION EXPERIMENT Final Report, 14 Jan. 1975 - 31 Jan. 1976
D. B. Hodge, D. M. Theobold, and R. C. Taylor Jan. 1976 31 p refs
(Contract NAS5-21983)
(NASA-CR-144737; ESL-3863-6) Avail: NTIS HC $4.00 CSCL 17B

The Ohio State University participation in the ATS-6 Millimeter Wavelength Propagation Experiment is summarized. Attenuation was measured simultaneously at 20 and 30 GHz on earth space propagation paths to two ground terminals located at Columbus, Ohio. In addition, 20 and 30 GHz radiometric temperatures were measured along the same propagation paths; and the 20 GHz radiometric temperature was also measured at a third ground terminal. The results of these measurements are presented, and diversity gains for the four pairs of propagation paths are discussed. The scintillation characteristics of the received signals are also presented. Author

N76-19212# Electrical Research Association, Leatherhead (England).
A STUDY OF LIMITATIONS IN RF SENSING SIGNALS DUE TO DISTORTIONS OF LARGE SPACECRAFT ANTENNAS Final Report
N. Adatia, P. R. Foster, and A. W. Rudge Sep. 1975 159 p refs
(Contract ESTEC-2330/74-AK)
(ESA-CR(P)-742) Avail: NTIS HC $6.75

The influence of large spacecraft antennas on the performance of RF sensing systems is discussed. Topics include monopulse postulates and parameters; phase and attenuation effects (Rhodes parameters); practical monopulse antennas such as the four-horn static-split, the peripheral-horn, and the multimode-horn RF sensors; spherical wave analysis; and reflector thermal deformation effects and radiation characteristics of RF sensing antennas. Computation of the spherical wave coefficients and primary feed models are dealt with in annexes. ESA

N76-19213# Electrical Research Association, Leatherhead (England). RF Technology Centre.
STUDY OF THE PERFORMANCE AND LIMITATIONS OF MULTIPLE-BEAM ANTENNAS. PART 1: STUDY, DESIGN, CONSTRUCTION AND EVALUATION OF A MULTIPLE-BEAM ANTENNA Final Report
A. W. Rudge, P. R. Foster, N. Williams, and N. Adatia Sep. 1975 163 p refs 2 Vol.
(Contract ESTEC-2277/74-HP)
(ESA-CR(P)-744) Avail: NTIS HC $6.75

The electrical performance and limitations of multiple-beam antennas for spacecraft applications were studied. A survey of the antenna types which offer a potential means of satisfying a general multiple-beam specification proposed by the European Space Agency was made. A recommendation for a 'preferred' antenna configuration comprising an offset parabolic reflector used in conjunction with a multiple-element primary-feed is given. Based upon this recommendation, a design procedure was established for circularly polarized offset reflector antennas (described in detail in Part 2 of the report). The design procedure was applied to an ESA specification for a multiple-beam antenna with 3 closely-spaced beams. The design, construction and experimental evaluation of a breadboard antenna is described. Finally, conclusions are drawn and recommendations made for future work in this technical area. Author (ESA)

N76-19214# Electrical Research Association, Leatherhead (England). RF Technology Centre.
STUDY OF THE PERFORMANCE AND LIMITATIONS OF MULTIPLE-BEAM ANTENNAS. PART 2: A DESIGN PROCEDURE FOR CIRCULARLY-POLARISED MULTIPLE-BEAM OFFSET REFLECTOR ANTENNAS Final Report
A. W. Rudge and N. Adatia Sep. 1975 39 p refs 2 Vol.
(Contract ESTEC-2277/74-HP)
(ESA-CR(P)-745) Avail: NTIS HC $4.00

Circularly polarized multiple beam offset reflector antennas were designed. The preferred configuration is comprised of an offset parabolic reflector used in conjunction with a multiple-element primary-feed. A step by step design procedure which accepts as input the multiple beam coverage requirements of the radiating system and the volumetric constraints on the spacecraft, and provides as output the principal parameters of the reflector and primary feed system is described. All of the necessary data to achieve this is provided in either graphical or simple mathematical form. Additional graphical data is provided to allow an estimate of the anticipated electrical performance of the design. Author (ESA)

N76-19215# Naval Postgraduate School, Monterey, Calif.
COMMUNICATIONS BY SATELLITE M.S. Thesis
Robert Earl Byrd Sep. 1975 79 p refs
(AD-A017539) Avail: NTIS CSCL 17/2

This paper covers some of the basic topics encountered by the communications manager faced with the task of familiarizing himself in the rapidly growing field of communications satellites. It is not intended to be an in-depth discussion but rather a brief introduction to the ionosphere, the decibel measurement system and some very basic rocket and space mechanics. Commercial ventures by INTELSAT have been most successful in this field and, for that reason, a section on INTELSAT and its progress has been included. Finally, a glossary of useful satellite terminology is included to supplement other available sources of information. Author (GRA)

N76-19216# California Univ., Los Angeles. Dept. of Geophysics and Space Physics
APPLICATION OF INVERSION THEORY TO NEW SATELLITE SYSTEMS FOR DETERMINATION OF THE GRAVITY FIELD Scientific Report, 1 Jul. 1974 - 30 Jun. 1975
W. M. Kaula, M. E. Paramenter, N. Burkhard, and D. D. Jackson 15 Aug. 1975 56 p refs
(Contract F19628-75-C-0007; AF Proj. 8607)
(AD-A017204; AFCRL-TR-75-0450) Avail: NTIS CSCL 17/9

Influence coefficients for gravity field and sea level effects on altimetry and satellite-to-satellite range rate are developed and used in orbital simulations. Inversion theory is extended to variables over two dimensional continuum and applied to gravity anomalies. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-19217*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO EVALUATE THE EFFECT OF EVA ON PAYLOAD SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
J. W. Patrick and E. F. Kraly 25 Nov. 1975 44 p
(Contract NAS2-8429)
(NASA-CR-137830; SD-75-SA-0028-Vol-1) Avail: NTIS HC $4.00 CSCL 22B

Programmatic benefits to payloads are examined which can result from the routine use of extravehicular activity (EVA) during space missions. Design and operations costs were compared for 13 representative baseline payloads to the costs of those payloads adapted for EVA operations. The EVA-oriented concepts developed in the study were derived from these baseline concepts and maintained mission and program objectives as well as basic configurations. This permitted isolation of cost saving factors associated specifically with incorporation of EVA in a variety of payload designs and operations. The study results were extrapolated to a total of 74 payload programs. Using appropriate complexity and learning factors, net EVA savings were extrapolated to over $551M for NASA and U.S. civil payloads for routine operations. Adding DOD and ESRO payloads increases the net estimated savings of $776M. Planned maintenance by EVA indicated an estimated $168M savings due to elimination of automated service equipment. Contingency problems of payloads were also analyzed to establish expected failure rates for shuttle payloads. The failure information resulted in an estimated potential for EVA savings of $1.9 B. Author

N76-19218*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO EVALUATE THE EFFECT OF EVA ON PAYLOAD SYSTEMS. VOLUME 2: TECHNICAL ANALYSES Final Report
J. W. Patrick and E. F. Kraly 25 Nov. 1975 310 p refs
(Contract NAS2-8429)
(NASA-CR-137831; SD-75-SA-0028-Vol-2) Avail: NTIS HC $9.75 CSCL 22B

For abstract, see N76-19217.

N76-19219*# Lockheed Missiles and Space Co., Huntsville, Ala.
THERMAL SUPPORT FOR SCALE SUPPORT Final Report
William G. Dean Jan. 1976 352 p refs
(Contract NAS8-25569)
(NASA-CR-144185; LMSC-HREC-TR-D496704) Avail: NTIS HC $10.50 CSCL 22B

The thermal design work completed for the Thermal Protection System (TPS) of the Space Shuttle System (TPS) of the space shuttle vehicle was documented. This work was divided into three phases, the first two of which reported in previous documents. About 22 separate tasks were completed in phase III, such as: hot gas facility (HGF) support, guarded tank support, shuttle external tank (ET) thermal design handbook support, etc. Y.J.A.

N76-19220# Friedman (Morris D.), Inc., West Newton, Mass.
INVESTIGATION OF THE FUNDAMENTAL CHARACTERISTICS OF THE ELECTROSTATIC COSMIC RADIATION SHIELD ON THE KOSMOS-605
E. E. Kovalev, E. D. Molchanov, Iu. G. Pekhterev, I. Ia. Riabova, V. I. Tikhomirov, and A. I. Khovanskaya 1975 7 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 13, no. 5, 1975 p 771-777
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The scientific apparatus complex mounted onboard the Kosmos-605 is described. The apparatus produces electrical fields with intensities to 14milbin v/cm near the satellite and measures the conduction current of the high voltage vacuum gap in order to determine the main characteristics of an electrostatic cosmic radiation shield. Author

N76-19221# National Aerospace Lab., Amsterdam (Netherlands).
SPACEFLIGHT TECHNOLOGY AT NLR
1975 11 p refs
Avail: NTIS HC $3.50

The inertial guidance system testing facilities built for the ELDO Europa 2 launch vehicle are described. Strapdown inertial systems and double gimballed momentum wheels for attitude control of spacecraft were developed. Mission analysis studies for ESRO satellites were performed. The Astronomical Netherlands Satellite is controlled by an NLR operations team. Studies for ESRO Helos (Exosat) satellite experiments and ESRO SPACELAB user requirements were also performed. ESA

N76-19180* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB PARASOL
Jack A. Kinzler *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 99-113 (For availability see N76-19172 10-12)
CSCL 22B

N76-19188* Sperry Flight Systems, Phoenix, Ariz.
MAGNETICALLY SUSPENDED REACTION WHEELS
Ajit V. Sabnis, George L. Stocking, and Joe B. Dendy *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 211-234 refs Prepared for JPL (For availability see N76-19172 10-12)
(Contract NAS7-100)
CSCL 22B

N76-19189* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Propulsion/Mechanical Dept.
USE OF COMPUTER MODELING TO INVESTIGATE A DYNAMIC INTERACTION PROBLEM IN THE SKYLAB TACS QUAD-VALVE PACKAGE
Raymond J. Hesser and Robert Gershman *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 235-246 refs (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-19222*# Stanford Univ., Calif. Guidance and Control Lab.
DESIGN OF STATE-FEEDBACK CONTROLLERS INCLUDING SENSITIVITY REDUCTION, WITH APPLICATIONS TO PRECISION POINTING
Zeev Hadass Aug. 1974 267 p refs
(Grant NGR-05-020-019; Contract F33615-72-C-1297)
(NASA-CR-146437; SUDAAR-482) Avail: NTIS HC $9.00 CSCL 22A

The design procedure of feedback controllers was described and the considerations for the selection of the design parameters were given. The frequency domain properties of single-input single-output systems using state feedback controllers are analyzed, and desirable phase and gain margin properties are demonstrated. Special consideration is given to the design of controllers for tracking systems, especially those designed to track polynomial commands. As an example, a controller was designed for a tracking telescope with a polynomial tracking requirement and some special features such as actuator saturation and multiple measurements, one of which is sampled. The resulting system has a tracking performance comparing favorably with a much more complicated digital aided tracker. The parameter sensitivity reduction was treated by considering the variable parameters as random variables. A performance index is defined as a weighted sum of the state and control convariances that sum from both the random system disturbances and the parameter uncertainties, and is minimized numerically by adjusting a set of free parameters. Author

N76-19223*# Transemantics, Inc., Washington, D.C.
PORTRAYING THE MORNING STAR (VENERA-9 AND -10 TELEVISION CAMERAS
Ye. Ivanov NASA Feb. 1976 7 p Transl. into ENGLISH

from Krasnaya Zvezda (USSR), 28 Oct. 1975 p 4
(Contract NASw-2792)
(NASA-TT-F-16889) Avail: NTIS HC $3.50 CSCL 17B

The difficulties associated with constructing the Venera-9 and -10 television cameras for operation on the Venus surface are described. A video signal was produced by direct optical-mechanical (mirror) scanning of the Venus landscape with telephotometers. Difficulties in creating an adequate seal between the glass window and the telephotometer housing are also described. Author

N76-19224# Saab-Scania, Goteberg (Sweden). Missile and Electronics Sector.
CONSTRUCTION AND TEST OF AN ENGINEERING MODEL ON BOARD COMPUTER. VOLUME 1: SUMMARY Final Report
John Hanje, Jan Torin, Mats Steinert, Lars-Ove Krook, Tore Lundberg, Arne Carlsson, Ernst Jonsson, and Boerge Riis-Vestergaard May 1975 68 p Prepared in cooperation with Christian Rovsing A/S 2 Vol.
(Contract ESTEC-1797/72-AA)
(SAAB-RA-OBC-5-084; ESA-CR(P)-739) Avail: NTIS HC $4.50

The construction and test of a modularized space borne computer engineering model is described. The computer is a mechanically and electrically representative prototype of a family of space borne computers to be developed. High reliability, low weight, low power consumption, and small volume were guiding design criteria. A great variety of computer configurations can be obtained, satisfying a wide range of requirements on reliability and processing capability. Modular redundant, as well as multiprocessing systems can be assembled. Furthermore, a computerized test equipment was built. It can be used to test the computer and the individual modules controlling the computer. It can also be used for software development and debugging purposes. An Assembler to be run on a greater host computer is also supplied. Author (ESA)

N76-19225# Saab-Scania, Goteberg (Sweden). Missile and Electronics Sector.
CONSTRUCTION AND TEST OF AN ENGINEERING MODEL ON BOARD COMPUTER. VOLUME 2: USER'S MANUAL Final Report
John Hanje, Jan Torin, Mats Steinert, Lars-Ove Krook, Tore Lundberg, Arne Carlsson, Ernst Jonsson, and Boerge Riis-Vestergaard May 1975 301 p Prepared in cooperation with Christian Rovsing A/S 2 Vol.
(Contract ESTEC-1797/72-AA)
(SAAB-RA-OBC-5-079; ESA-CR(P)-740) Avail: NTIS HC $9.75

Instructions for the use of an engineering model on board computer (OBC), developed for ESTEC at SAAB-SCANIA, are given. The manual covers: systems description, instruction set, assembler program including XAL source language characteristics, simulator program, input/output system, interrupt system, physical configuration of the OBC, system interconnection, system reliability, and system operation. ESA

N76-19226# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A SMOKE DETECTION SYSTEM FOR MANNED SPACECRAFT APPLICATIONS Final Report, Jul. 1970 - Jul. 1974
Terry H. Trumble Jun. 1975 108 p refs
(AF Proj. 3048)
(AD-A015744; AFAPL-TR-74-97) Avail: NTIS CSCL 21/2

This report describes the development, from concept to hardware, of an open path optical system for detecting smoke in manned spacecraft. Studies were conducted on the nature of light scattering through smoke as well as the nature of the particle statistics in smoke. These studies resulted in the selection of the 2537A wavelength for smoke detection and the use of the 2537A/3129A ratio for discrimination from background particulates. Test results on the first laboratory unit constructed are included, and indicate that the concept is feasible and practicable. Present programs in this area are discussed in the Summary and Conclusions section of this report. Author (GRA)

N76-19175* Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL EVALUATION OF DEPLOYABLE AERODYNAMIC SPIKE BOOMS
B. J. Richter *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 31-43 ref (For availability see N76-19172 10-12)
CSCL 14B

N76-19182* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REFURBISHMENT OF THE CRYOGENIC COOLERS FOR THE SKYLAB EARTH RESOURCES EXPERIMENT PACKAGE
Jerry C. Smithson and Norman C. Luksa *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 133-148 ref (For availability see N76-19172 10-12)
CSCL 14B

N76-19187* Santa Barbara Research Center, Goleta, Calif.
THE MECHANICAL DESIGN OF AN IMAGING PHOTOPOLARIMETER FOR THE JUPITER MISSIONS (PIONEER 10 AND 11)
James C. Kodak *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 199-209 (For availability see N76-19172 10-12)
(Contract NAS2-5605)
CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-19227*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANODE FOR ION THRUSTER Patent Application
Bruce A. Banks, inventor (to NASA) Filed 8 Mar. 1976 12 p
(NASA-Case-LEW-12048-1; US-Patent-Appl-SN-665033) Avail: NTIS HC $3.50 CSCL 21C

A screen anode for an ion thruster is described. The anode is constructed of a woven mesh screen, preferably of a stainless steel wire cloth with a mesh size less than the intergrid gap or openings of the screen grid or accelerator grid systems of the thruster. The screen anode is sputter coated with tantalum as a result of thruster operation. Because of the fineness of the screen anode any spalled material from the tantalum coated anode is in such small dimensions that the spalled pieces cannot interfere with the accelerator, screen grid systems, and the focusing. NASA

N76-19228*# Colorado State Univ., Fort Collins.
THEORETICAL EVALUATION OF RIGID BAFFLES IN THE SUPPRESSION OF COMBUSTION INSTABILITY
M. R. Baer and C. E. Mitchell Mar. 1976 137 p refs
(Grant NGR-06-002-095)
(NASA-CR-134986) Avail: NTIS HC $6.00 CSCL 21H

An analytical technique for the prediction of the effects of rigid baffles on the stability of liquid propellant combustors is presented. This analysis employs both two and three dimensional combustor models characterized by concentrated combustion sources at the chamber injector and a constant Mach number nozzle. An eigenfunction-matching method is used to solve the linearized partial differential equations describing the unsteady flow field for both models. Boundary layer corrections to this unsteady flow are in a mechanical energy dissipation model to evaluate viscous and turbulence effects within the flow. An integral instability relationship is then employed to predict the decay rate of the oscillations. Results of this analysis agree qualitatively with experimental observations and show that sufficient dissipation exists to indicate that the proper mechanism of baffle damping is a fluid dynamic loss. The response of the dissipation model to varying baffle blade length, mean flow Mach number,

oscillation amplitude, baffle configuration, and oscillation mode is examined. Author

N76-19229*# Boeing Aerospace Co., Seattle, Wash.
THREE DIMENSIONAL THRUST CHAMBER LIFE PREDICTION Final Contractor Report
William H. Armstrong and E. W. Brogren Mar. 1976 119 p refs
(Contract NAS3-19717)
(NASA-CR-134979; D180-19309-1) Avail: NTIS HC $5.50 CSCL 21H

A study was performed to analytically determine the cyclic thermomechanical behavior and fatigue life of three configurations of a Plug Nozzle Thrust Chamber. This thrust chamber is a test model which represents the current trend in nozzle design calling for high performance coupled with weight and volume limitations as well as extended life for reusability. The study involved the use of different materials and material combinations to evaluate their application to the problem of low-cycle fatigue in the thrust chamber. The thermal and structural analyses were carried out on a three-dimensional basis. Results are presented which show plots of continuous temperature histories and temperature distributions at selected times during the operating cycle of the thrust chamber. Computed structural data show critical regions for low-cycle fatigue and the histories of strain within the regions for each operation cycle. Author

N76-19230# School of Aerospace Medicine, Brooks AFB, Tex.
COULOMETRIC MEASUREMENT OF HCl IN SPACE LAUNCH VEHICLE EXHAUST Progress Report, Jul. 1973 - Jun. 1974
Robert C. Legday, Richard L. Miller, and David C. Beatty Sep. 1975 21 p refs
(AF Proj. 7164)
(AD-A016992; SAM-TR-75-27) Avail: NTIS CSCL 21/9

Large solid-propellant rocket motors release quantities of hydrogen chloride (HCl) gas as a product of combustion. Since HCl is a potential environmental hazard, the measurement of its concentration in the stabilized rocket exhaust ground cloud becomes important to validate diffusion estimates governing launch constraints, as well as to assess the biologic and ecologic impact of HCl reactions which may occur in the exhaust plume. This paper describes the development and test of a microcoulometer for detection of HCl in rocket exhaust, and presents analytical results from Titan III launch vehicle monitoring studies at Cape Canaveral, Florida, and Vandenberg Air Force Base, California. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N76-19231*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METHOD FOR FABRICATING GRAPHITE/EPOXY LAMINATE FROM ULTRATHIN LAMINAE Patent Application
Bernard M. Burke, Sr. (Martin Marietta Corp., Denver) and John R. Lager, inventors (to NASA) (Martin Marietta Corp., Denver) Filed 10 Mar. 1976 11 p Sponsored by NASA
(NASA-Case-MFS-23223-1; US-Patent-Appl-SN-665364) Avail: NTIS HC $3.50 CSCL 11D

A method for fabricating graphite/epoxy laminate from ultrathin graphite/epoxy laminas is described. The method is characterized by forming an uncured laminate comprising a plurality of superimposed, ultrathin graphite/epoxy laminas, the fibers of each lamina being arranged in substantial parallelism and angularly related to the fibers of adjacent laminas. The uncured laminate is interposed between perforated backing laminas for forming a curing package which is vacuum bagged, preheated, and smoothed for removing surface irregularities. The package is subjected to pressure and temperature sufficient for curing the epoxy resin. NASA

N76-19232*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ELECTRONIC EQUIPMENT FOR DETERMINING THE CHARACTERISTICS OF MECHANICAL AND OTHER PROPERTIES OF FIBERS IN SINGLE-STAGE TENSION OF FAILURE
G. Ya. Shers Washington NASA Mar. 1976 148 p refs Transl. into ENGLISH of the book "Elektronnaya Apparatura dlya Opredeleniya Kharakteristki Mekhanicheskikh i Drugikh Svoystv Yolokon pri Odnokratonom Rastyazhenii do Razryva" Moscow, Legkaya Industriya Press, 1975 p 1-128
(Contract NASw-2789)
(NASA-TT-F-16881) Avail: NTIS HC $6.00 CSCL 11E

Methods for controlling failure loads and failure extensions are discussed. Electronic circuitry for the control of the thickness of chemical fibers and the electronic mechanical and recording devices for tensile-testing machines are discussed. Also described are the polymer-type tensile testing machines and the results of their introduction; some individual makes of fiber control equipment are listed as well. This book has been designed for technical engineering special lists in the textile industry. Author

N76-19233*# Stanford Research Inst., Menlo Park, Calif. Electromagnetic Sciences Lab.
PHOTOCONDUCTIVITY OF HIGH-VOLTAGE SPACE INSULATING MATERIALS Final Report, 1 Jul. 1974 - 1 Oct. 1975
H. T. Coffey, J. E. Nanevicz, and R. C. Adamo Oct. 1975 67 p refs
(Contract NAS3-18912; SRI Proj. 3545)
(NASA-CR-134995) Avail: NTIS HC $4.50 CSCL 11D

The dark and photoconductivities of four high voltage spacecraft insulators, Kapton-H, FEP Teflon, Parylene, and fused quartz, were studied under a variety of conditions intended to simulate a space environment. All measurements were made in a vacuum of less than .00001 torr while the temperature was varied from 22 C to 100 C. Some of the samples used employed conventional deposited metal electrodes--others employed electrodes composed either of an electron beam or a plasma formed by ionization of the residual gas in the test chamber. Test results show: (1) Kapton had unusual conduction properties; it conductivity decreased by more than an order of magnitude when heated at 100 C in a vacuum, but ultimately attained a stable and reproducible value. (2) Both Teflon and fused quartz had high dark resistivities but low photoresistivities when exposed to UV. Optical-density measurements revealed that both materials transmitted UV with little attenuation. (3) Parylene was found to have a low but relatively stable resistivity--comparatively minor changes occurred upon heating or illuminating the sample. Optical-density measurements showed that Parylene was absorbent in the UV and would prevent photoemission from the metal electrode on the back surface. Author

N76-19234*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BONDING OF SAPPHIRE TO SAPPHIRE BY EUTECTIC MIXTURE OF ALUMINUM OXIDE AND ZIRCONIUM OXIDE Patent Application
John J. DeLuca, inventor (to NASA) Filed 30 Dec. 1975 14 p
(NASA-Case-GSC-11577-3; US-Patent-Appl-SN-645502) Avail: NTIS HC $3.50 CSCL 11D

Bonding of an element comprising sapphire, ruby or blue sapphire to another element of such material with a eutectic mixture of aluminum oxide and zirconium oxide is reported. The bonding mixture may be applied in the form of a distilled water slurry or by electron beam vapor deposition. In one embodiment the eutectic is formed in situ by applying a layer of zirconium oxide and then heating the assembly to a temperature above

the eutectic temperature and below the melting point of the material from which the elements are formed. The formation of a sapphire rubidium maser cell utilizing eutectic bonding is shown. NASA

N76-19235# Advisory Group for Aerospace Research and Development, Paris (France).
DESIGN OF STRUCTURES IN COMPOSITE MATERIALS (BASIC DATA AND INTERDISCIPLINARY ACTION)
Jan. 1976 23 p refs
(AGARD-R-639; ISBN-92-835-0152-7) Avail: NTIS HC $3.50

Quality control in the manufacturing of composite materials for use in aircraft structures is discussed. Also discussed are interdisciplinary approaches for materials and design engineers in the development of advanced composites. For individual titles, see N76-19236 through N76-19237.

N76-19236 British Aircraft Corp., Warton (England).
GENERATION OF COMPOSITE MATERIAL DATA FOR DESIGN
I. C. Taig *In* AGARD Design of Struct. in Composite Mater. (Basic Data and Interdisciplinary Action) Jan. 1976 p 1-7 (For availability see N76-19235 10-24)

Quality control in the manufacturing of fiber composites (laminates) used in aircraft construction is discussed. Specifically considered is the availability of technical information on the mechanical and thermal properties of laminates. The availability of this information is presented in tabular form. A rating scale (lettered A to E) serves as a key to the tables and indicates either extensive technical information (i.e, letter A) or minimal technical information (i.e., letter E). Exposure of laminates to the manufacturing environment (e.g. humidity, solvents) is also considered. It is proposed that the burdensome requirement that every primary composite has its own development program can be eliminated if components are built in standardized ways from a finite family of layups using previously developed structural elements. J.R.T.

N76-19237 Grumman Aerospace Corp., Bethpage, N.Y.
COMPOSITE MATERIALS DESIGN FROM A MATERIALS AND DESIGN PERSPECTIVE
A. August, R. Hadcock, and S. Dastin *In* AGARD Design of Struct. in Composite Mater. (Basic Data and Interdisciplinary Action) Jan. 1976 p 9-19 refs (For availability see N76-19235 10-24)

The aerospace industry in the United States has made significant strides in the development of advanced composite technology, for primary as well as for secondary structural applications. This technology has advanced to the point where the feasibility of using these materials is no longer questioned. Unfortunately, applications which can reap the benefits of the technology have not developed as fast as they should, since improvements in technical (know-how) education, and experience are required in a number of areas. One such area is the interface between the design engineer and the materials engineer. The significance of the design engineering/materials engineering interface in the development of advanced structures is examined. To achieve a smooth-working design/materials interface, long-term emphasis in three specific areas is suggested: (1) education (on the industrial level and also back to the colleges and universities), (2) interdisciplinary development of advanced composites, and (3) development of composites test standards. Author

N76-19238# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
AN INVESTIGATION OF CRACK RESISTANCE IN COMPOSITE REINFORCED FACE SHEETS OF SANDWICH PANELS
G. Bartelds and A. Nederveen 9 Oct. 1974 24 p
(Contracts RNLAF-RB-C6-108.322; NIVR-1769)
(NLR-TR-74150-U) Avail: NTIS HC $3.50

Aluminum sandwich panels provided with carbon-epoxy uniaxial reinforcing strips were fatigued and subsequently tested for residual strength. Although both analysis and fatigue tests indicate that the crack tip zone is affected only when the zone is in the immediate vicinity of a stiffener, the reinforcement considerably increases crack resistance with regard to ultimate panel strength. In the present test series a simple reinforcement that added only 2.5% to basic panel weight raised the lower limit of residual strength to 2/3 of basic undamaged reinforced panel strength for crack lengths up to 0.4 of panel width. Unstable growth of cracks with a length of approximately 0.5 times the panel width was stopped at the composite strips. Author (ESA)

N76-19239# Massachusetts Inst. of Tech., Cambridge. Sea Grant Project Office.
EFFECT OF WATER ON THE CRACK PROPAGATION RATE IN FIBERGLASS LAMINATES UNDER STATIC AND DYNAMIC LOADING
John F. Mandell, Frederick J. McGarry, Donald S. Barton, and Robert P. Demchick 15 Sep. 1975 51 p refs Sponsored in part by Dow Chem. Co., Midland, Mich.
(Contract F33615-72-C-1686; Grants NOAA-04-5-158-1; NSF GH-33653)
(PB-246411/3; MITSG-75-18; NOAA-75092302) Avail: NTIS HC $4.50 CSCL 11D

The rate of stable crack propagation in fiberglass laminates was investigated under static and dynamic loading conditions in wet and dry environments. Crack propagation rates were measured as a function of the stress intensity factor over several decades in each case, and total specimen lifetimes were also recorded. The dynamic crack growth data were in good agreement with predictions based on a simple theoretical model, but no accurate prediction of the static results was possible. The effect of water in each case was to increase the crack growth rate for dynamic (cyclic) loading, but to decrease the rate for static loading. GRA

N76-19240# Maryland Univ., College Park. Dept. of Mechanical Engineering.
A PHOTOELASTIC STUDY OF THE DYNAMIC FRACTURE BEHAVIOR OF HOMALITE 100
George R. Irwin, James W. Dally, Takao Kobayashi, and Jeffrey M. Etheridge Sep. 1975 132 p refs
(Contracts AT(49-24)-0174; AT(40-1)-4801)
(PB-246323/0; NUREG-75/107) Avail: NTIS HC $6.00 CSCL 11D

An experimental investigation of the dynamic behavior of cracks propagation in Homalite 100, a brittle thermosetting polymeric material is described. Dynamic photoelastic isochromatic fringe patterns associated with cracks propagating in center-pin-loaded, eccentric-pin-loaded and crack-line-loaded SEN specimens were recorded with a high speed multiple spark camera. Data were obtained from 11 tests over a range of crack velocities from arrest to the terminal velocity of 15,000 in/sec. GRA

N76-19241# United Aircraft Corp., Stratford, Conn. Aircraft Div.
STATIC AND FATIGUE DAMAGE CHARACTERIZATION IN COMPOSITE MATERIALS Final Report, Jun. 1974 - Jul. 1975
Joseph J. Nevadunsky, C. J. Matusovich, and John J. Lucas Aug. 1975 58 p refs
(Contract F44620-73-C-0043; AF Proj. 9782)
(AD-A017632; SER-50939; AFOSR-75-1535TR) Avail: NTIS CSCL 11/4

The purpose of the investigation was to characterize two composite laminates. This was accomplished by identifying static and fatigue modes present within the laminates by fractographic and non-destructive test methods and relating them to stiffness loss. Torsional and axial modulus measurements were employed to quantitatively characterize the materials. Microscopic examinations, both visual and SEM were used to destructively evaluate the failure mechanisms present at various stages of static and fatigue damage. Observations of heat generation, ultrasonics, holographic interferometry, and speckle interferometry were conducted to qualitatively characterize both the failure mechanisms and stiffness loss they cause. This approach is aimed at completely characterizing composite laminates for their structural integrity throughout their static and fatigue lives. GRA

N76-19242# Tennessee Univ. Space Inst., Tullahoma. Dept. of Metallurgical Engineering.
THE MECHANICAL PROPERTIES OF METAL MATRIX

COMPOSITES SUBJECTED TO CYCLIC TEMPERATURE CHANGES Technical Report, 1 Jul. 1974 - 30 Jun. 1975
Maurice A. Wright Oct. 1975 66 p refs
(Contracts N00014-75-C-0352; N00014-71-A-0121-0003; NR Proj. 031-760)
(AD-A017448; MET-E-751) Avail: NTIS CSCL 11/4

Part I: The strength of metal matrix materials reinforced with unidirectional brittle fibers is shown to be best described in terms of upper and lower bounds. Tensile strength and fracture toughness values were obtained from 6061 aluminum reinforced with boron or silicon carbide fibers. The as-received, heat treated and thermally fatigued conditions were investigated and similar tests were carried out on cross-plied, 0/90 degrees, boron reinforced material. The failure of the slotted specimens is discussed in terms of strength bounds similar in concept to those proposed to describe the tensile strength results. Part II: The mechanical properties of various boron and silicon carbide fiber reinforced 6061 aluminum matrix specimens were measured both before and after subjecting the specimens to repeated cyclic temperature variations between room temperature and 698 K. The results of dilatometer experiments are discussed in terms of creep at the elevated temperatures and the generation of large tensile internal stresses in the matrix at room temperature. It is hypothesized that these effects degrade the strength of the fiber-matrix bond and eventually cause breakage of individual fibers. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-19243 Utah State Univ., Logan.
CONDUCTANCE AND EVANESCENT WAVE SPECTROSCOPY AS APPLIED TO THIN FILMS IN ELECTROCHEMISTRY Ph.D. Thesis
Thomas Willard Humpherys 1975 145 p
Avail: Univ. Microfilms Order No. 76-6227

Conductance and evanescent wave spectroscopy measurements, obtained from optically transparent thin metallic film electrodes in an electrochemical cell, were made and found to provide further information about the electrode interphase. Transmission spectroscopy coupled with evanescent wave spectroscopy enabled tin oxide, indium oxide, gold, chromium, and even adsorbed monolayers to be optically characterized. The films used as electrodes must be reliably represented by sets of optical constants. It was found that three transmission absorbance measurements of a thin film may be sufficiently independent to numerically invert for determination of the optical constants of that film. The criteria a film must meet in order to be characterized by the all transmission method are discussed in terms of adjustable experimental parameters, the presence of intermediate films, the thin film optical constants and corresponding E fields, and an error analysis. Dissert. Abstr.

N76-19244 Illinois Univ., Urbana.
HIGH PRESSURE THERMODYNAMIC AND SPECTROSCOPIC STUDIES ON OXYGEN STABILIZATION AND COORDINATION Ph.D. Thesis
Tony John Beugelsdijk 1975 133 p
Avail: Univ. Microfilms Order No. 76-6692

The role of molecular oxygen as a ligand toward the transition metal complex (base)cobalt(II) protoporphyrin IX dimethyl ester has been investigated and quantified in terms of the thermodynamic parameters associated with oxygen binding. After generating in situ the five coordinate base-metalloporphyrin adduct, the solutions are exposed to increasing pressures of oxygen. Characteristic changes in the visible spectrum due to the formation of the oxygen adduct are used to determine the equilibrium constant. Measurements of several temperatures lead to the enthalpy and entropy of interaction. All spectroscopic heats so obtained show noticeably little deviation from an average value of -8.00 kcal/mole. Dissert. Abstr.

N76-19245 Virginia Univ., Charlottesville.
NEW TECHNIQUES IN CHEMICAL IONIZATION MASS SPECTROMETRY Ph.D. Thesis
Thomas Michael Harvey 1975 201 p
Avail: Univ. Microfilms Order No. 75-28067

The mechanisms for many of the unusual ion-molecule reactions with NO(+) were studied in detail. Ions at m/e 86, m/e 100 etc., in the CI(NO) spectral terminal olefins appear to arise from a combination of a cyclization, rearrangement reaction, and rapid hydride migration followed by beta cleavage. Systematic studies of several variables including chain length, temperature, and NO partial pressure were carried out for the reactions of alkanese and alcohols with NO(+). In addition CI(NO) spectra were obtained for selected deuterium labelled compounds. These results combined with thermodynamic considerations suggest ions at M-2 + 30 and M-3 in the spectra of alkanes and alcohols require the intermediacy of a complex consistency of NO(+), a sample molecule, and a neutral NO molecule. Several gases including hydrogen, oxygen, water, and nitric oxide were tested as negative ion reagents. The spectra were found to be comparable in sensitivity to positive ion CI and superior to negative ion electron impact for the production of ions in the molecular weight region. Dissert. Abstr.

N76-19246 California Univ., Santa Barbara.
HOT ATOM PHOTOCHEMISTRY Ph.D. Thesis
Gary Don Beverly 1974 305 p
Avail: Univ. Microfilms Order No. 76-4870

Hot hydrogen atoms with initial energies from 1.1 - 3.6 eV were generated photochemically and used to study hydrogen abstraction reactions from alkanes. The integral reaction probability for H* + n-C4D10 was measured and a previous erroneous measurement of IRP was corrected and explained. The isotope effect for abstraction of H versus D from various isotopically substituted ethanes was measured by a competitive technique both inter- and intra-molecularly. The observed isotope effect, favoring abstraction of H over D, increases with the average energy of hot reaction, is larger for H* attack than D* attack, and is a reactive, primary isotope effect. Additionally, the photolysis of methyl iodide at 185.0 nm was studied and new primary processes involving both the molecular elimation of hydrogen and the production of hot hydrogen atoms were tentatively identified. Studies of hot chlorine atom reactions failed due to certain difficulties. Dissert. Abstr.

N76-19247*# Transemantics, Inc., Washington, D.C.
THE RELATIONSHIP BETWEEN NITROSE DENSITY AND ITS COMPOSITION
I. F. Cherepkov Feb. 1976 12 p ref Transl. into ENGLISH from Khim. Prom. (USSR) no. 3, 1956 p 8(136) - 10(138)
(Contract NASw-2792)
(NASA-TT-F-16885) Avail: NTIS HC $3.50 CSCL 07D

For proper conduct of the technological process of the production of sulfuric acid according to the nitrose method, it is necessary to know the composition of the nitroses circulating in the reaction apparatuses. The results are presented of an experimental determination of the relationship of the density of a nitrose to its composition, along with proposed nomograms linking the density of a nitrose to the density of the solvent of nitrosylsulfuric acid, i.e., to the density of the sulfuric acid which remains free after complete bonding of all the nitrogen oxides in the nitrose with sulfuric acid into stable nonhydrolized molecules of nitrosylsulfuric acid. Also presented are formulas and graphs which are useful not only for practical purposes when determining the composition of a nitrose under production conditions, but also during further study of various properties of the nitrose. Author

N76-19248*# Scientific Translation Service, Santa Barbara, Calif.
BEHAVIOR OF THE POROUS STRUCTURE OF CARBON REACTING WITH CARBON DIOXIDE AT HIGH PRESSURES AND TEMPERATURES
Ye. S. Golovina, L. S. Solovyeva, and V. G. Samsonov Washington NASA Mar. 1976 15 p refs Transl. into ENGLISH from Khim. Tverdogo Topliva (USSR), no. 2, 1974 p 147-153

(Contract NASw-2791)
(NASA-TT-F-16958) Avail: NTIS HC $3.50 CSCL 07D

At 1,300-3,400 K and 1-40 atm pressure according to the BET method, experimental data were obtained with respect to deep-zone reactions and the distribution of the specific surface was obtained with respect to the radius of the spherical C samples reacting with CO2. The reaction proceeds under diffusion or migration conditions and is not limited by mass transfer; the increasing pressure retards the reaction which is of fractional order. Author

N76-19249*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
IGNITION MECHANISM AND COMBUSTION OF COAL DUST PARTICLES
Dieter Stalherm, Harald Juentgen, and Werner Peters Washington NASA Mar. 1976 20 p refs Transl. into ENGLISH from VDI-Ber. (West Germany), no. 211, 1974 p 131-137
(Contract NASw-2789)
(NASA-TT-F-16936) Avail: NTIS HC $3.50 CSCL 21B

The reactivity rates of coal were studied during coal dust firing. It was found that they increase proportionally with volatile content. Experiments were conducted with particles below 250 microns. Photographic method was used to record the combustion process, reactivity and temperature of ignition. Mass spectrometer was used to study the formation of pyrolysis products in vacuum. The results are discussed. Author

N76-19250# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
FAST KINETIC METHODS APPLICABLE TO TRACE CHEMICAL ANALYSIS AND DETECTION Final Report, 1 Nov. 1970 - 30 Apr. 1975
Dale W. Margerum and Harry L. Pardue Aug. 1975 13 p refs
(Grant AF-AFOSR-1988-71; AF Proj. 9536)
(AD-A015854; AFOSR-75-1363TR) Avail: NTIS CSCL 07/4

Briefly described is research concerning the improved detection of chemical species in stopped-flow spectroscopy and the application of kinetic methods to chemical analyses. The research has included: development of rapid scanning spectrometers using vidicon tubes; development of computer-controlled stopped-flow studies; kinetic methods of analysis; kinetics of oxidation of aminopolycarboxylate complexes of bivalent metal ions by halogens; and detection of chloramines and the chemistry of chloramines. GRA

N76-19251# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES Final Report, Mar. 1974 - Aug. 1975
N. Johnson and S. Sanderson Sep. 1975 212 p refs
(Contract DOT-HS-4-00872)
(PB-245888/3; Dyn-Sci-2310-75-118; DOT-HS-801-722) Avail: NTIS HC $7.75 CSCL 13L

The conditions are defined under which motor vehicle crash fires are ignited along with proposed practicable countermeasures to reduce the incidence of these fires. Both ignition sources and fuel spillage were investigated. It demonstrated through the mechanics of crash testing, the type of fire safety protection that can be provided by present technology. GRA

N76-19252# Columbia Univ., New York.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Jul. 1974 - 30 Jun. 1975
Sven R. Hartmann and William Happer 30 Jun. 1975 128 p refs
(Contract DAAB07-74-C-0341; Grant NSF 38503)
(AD-A016105; PR-25) Avail: NTIS CSCL 07/4

Research in the following areas is described: atomic physics; physics of molecules; resonance physics; and, macroscopic quantum physics. GRA

N76-19253# Brigham Young Univ., Provo, Utah. Coll. of Engineering Sciences and Technology.
RESEARCH ON NON-STEADY COMBUSTION AND EXTINGUISHMENT Final Report
Howard S. Heaton, Ralph L. Coates, and M. Duane Horton May 1975 71 p refs
(Grant AF-AFOSR-1895-70; AF Proj. 6813; AF Proj. 9711)
(AD-A016064; AFOSR-75-1362TR) Avail: NTIS CSCL 21/2

Experimental and theoretical studies were carried out on acoustic instability during combustion of solid propellants. The objective of the experimental tests was to find a set of three parameters, Eg, Es, Ts for a new theoretical model which would consistently correlate experimental data. Tests of burning rate, flame temperature, L*-instability, and T-burner instability were run for five different propellants and the three parameters were determined. A correlation of the theoretical model with the experimental data was made and the results were reasonably good and better than previous correlations. A previously developed non-linear computer model of the T-burner was extended to allow high amplitude pressure oscillations and damping from heat transfer and fluid friction. Significant pressure wave steepening was found with high amplitude oscillations. Momentum loss out the vent was found to be the dominant damping effect. GRA

N76-19254# General Applied Science Labs., Inc., Westbury, N.Y.
AN EXPERIMENTAL COMBUSTION AND FLAME STABILIZATION STUDY OF DUMP BURNERS
Stephen N. Schmotolocha and Constantino Economos Sep. 1975 106 p refs
(Contract F44620-71-C-0014)
(AD-A015708; GASL-TR-792; AFOSR-75-1446TR) Avail: NTIS CSCL 21/2

An experimental investigation of the mixing, flammability and combustion mechanisms of dump burners was conducted. Tests were carried out with a 9:1 expansion area coaxial configuration at atmospheric burner pressure, and over a wide spectrum of air velocity, air temperature and fuel/air ratio. Liquid JP-4 was injected normal to the airstream through eight orifices located in the inlet wall upstream of the burner. The effects of air flow conditions, fuel injection location, global equivalence ratio, and secondary hot and cold oxidizer injections on mixing, ignition, blow-out flameholder base region and combustor performances were studied. GRA

N76-19255# Washington Univ., Seattle. Lab. for Chemometrics.
MEASUREMENT ANALYSIS BY PATTERN RECOGNITION Technical Report, Aug. 1974 - Aug. 1975
Bruce R. Kowalski Aug. 1975 32 p refs
(Contract N00014-75-C-0536; NR Proj. 051-565)
(AD-A015718; TR-8) Avail: NTIS CSCL 07/4

This report describes the current state of the art and future projections for the development and application of pattern recognition in chemistry. Emphasis is on the analysis of analytical chemistry measurements, but discussion of other chemical applications is also included. GRA

N76-19256# Stanford Research Inst., Menlo Park, Calif.
SENSITIVITY FUNDAMENTALS Semiannual Technical Progress Report, 1 Jan. - 30 Jun. 1975
D. S. Ross, N. A. Kirshen, and T. Mill Aug. 1975 20 p refs
(Contract N00014-70-C-0190)
(AD-A015924; SRI-TPR-75-1) Avail: NTIS CSCL 07/4

The suggestion that a pressure-sensitive equilibrium is important to the initiation of detonation in nitroalkanes has been tested. First, considered was the potentially important step NO + NO2 reversible reaction + N2O3 to O2 + N2O and the thermal decomposition of N2O3 at 130C and about 35 atm. When a small amount of water was added to the system, a violent explosion occurred after about 5 minutes of heating. The reaction between NO and NO2 may be water catalyzed and may offer some insight into the energetics of nitroalkane detonation. Also studied was the oxidizing abilities of NO2/N2O4 systems at 100C and 10-20 atm., using isobutane as the organic substrate. The rate of reaction was determined. The results are consistent with our proposition that under detonation initiation (high pressure-high temperature) conditions N2O4 is the p predominant species and is in some way responsible for the oxidation. GRA

N76-19257# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
EXTRACTION OF FARADAIC SIGNALS FROM FLASH PHOTOCURRENT MEASUREMENTS: BENZOPHENONE PHOTOLYSIS
K. F. Dahnke, S. S. Fratoni, Jr., and S. P. Perone Sep. 1975 42 p refs
(Contract N00014-75-C-0874; NR Proj. 051-552)
(AD-A015641; TR-6) Avail: NTIS CSCL 07/4

The first paper in this series developed a theoretical model for characterizing the charging currents induced by changing faradaic currents measured under potentiostatic conditions. Of specific concern here are photoelectrochemical measurements, although the principles are generally applicable to chronoamperometry. This paper is concerned with experimental verification of the predicted relationships and demonstration of the direct applicability of the model to the correction of experimental data for more accurate determination of faradaic currents. Corrected and uncorrected data are given for the potentiostatic and potential-step cases, both in the form of current-time profiles and Cottrell plots. Effects of variation of the cell time constant are presented to further demonstrate the magnitude of the charging effect and consistency of the model. The flash photolysis instrumentation, including computerization, used to obtain the experimental data for this work is also described. GRA

N76-19258# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
A THEORETICAL MODEL FOR INDUCED CHARGING CURRENTS IN POTENTIOSTATIC CHRONOAMPEROMETRY. APPLICATIONS TO PHOTOELECTROCHEMISTRY
S. S. Fratoni, Jr. and S. P. Perone Sep. 1975 39 p refs
(Contract N00014-75-C-0874; NR Proj. 051-552)
(AD-A015634; TR-5) Avail: NTIS CSCL 07/4

It has been assumed previously that charging current is only significant for electrochemical experiments where the applied potential is varied (e.g.; potential step, potential sweep). This paper deals with characterization of charging current contributions to chronoamperometric measurements under potentiostatic conditions, where the charging current is induced by the changing faradaic current. This case corresponds directly to the conditions for chronoamperometric measurements of flash photolytic processes, commonly called photopolarography. A theoretical model applicable to any electrolysis mechanism, and a general method of analysis, are presented to characterize this charging current. In addition, the model is extended to include potential-step chronoamperometry. Application of this model to these two specific cases demonstrates the significance of the charging current term relative to measured current. GRA

N76-19259# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
THEORY FOR INDUCED CHARGING CURRENTS IN POTENTIOSTATIC CHRONOAMPEROMETRY INVOLVING COUPLED CHEMICAL REACTIONS. APPLICATIONS TO PHOTOELECTROCHEMISTRY
S. S. Fratoni, Jr. and S. P. Perone Sep. 1975 26 p refs
(Contract N00014-75-C-0874; NR Proj. 051-552)
(AD-A015642; TR-7) Avail: NTIS CSCL 07/4

Previously a theoretical model was developed for characterizing the charging currents induced by changing faradaic currents measured under potentiostatic conditions. This paper describes application of the theoretical model to measurements involving electrolysis mechanisms complicated by competing reactions. The model is particularly relevant for flash photoelectrochemical studies. The mechanisms considered here include 1st-order and 2nd-order decay of electroactive photoproducts. The dependence of measured currents on various experimental and chemical parameters--including the cell time-constant, photoproduct concentrations, and rate constants--is described for a wide range of conditions. Theoretical relationships can be used to predict total measured currents, or to tabulate correction factors to extract purely faradaic currents from measured currents. In addition, an alternative derivative-correction method for extracting faradaic signals from combined currents is described. GRA

N76-19260# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
MEASUREMENTS OF INFRARED RADIATION CHARACTERISTICS OF A SMALL KEROSENE/GASEOUS OXYGEN HOT GAS GENERATOR
H. Tracy Jackson, Jr., Frank Poslajko, and Kenneth E. Harwell (Auburn Univ.) 3 Jul. 1975 104 p ref
(AD-A017296; RE-76-1) Avail: NTIS CSCL 07/4

Experimental measurements of the spatial and spectral distribution of infrared radiation emitted from the exhaust plume of a small kerosene/gaseous oxygen hot gas generator operating at ambient conditions were obtained for oxidizer/fuel ratios between 1.15 and 3.0. The axial distribution of infrared radiant intensity was observed to have a series of maxima and minima ('hot spots') which corresponded to the location of shock waves or Mach discs in the central portion of the exhaust plume. For oxidizer/fuel ratios less than 3, the radiation peak occurred many nozzle radii downstream and the magnitude of the radiant intensity was larger than the peak value behind the first reflected shock wave. For oxidizer/fuel ratios greater than 3, the peak radiation occurred in the first shock-heated zone. It was observed that even though the shock heated regions produced locally very high values of the radiant intensity, the majority of the total radiation is emitted from the afterburning plume downstream of the shock zones. The spectral distribution measurements indicated that the principal radiation was in the 4.4 micrometer band from hot water vapor and carbon dioxide. GRA

N76-19261# California Univ., Santa Cruz.
CHEMICAL REACTIONS INDUCED BY ULTRAVIOLET AND IONIZING RADIATION Final Report, 1 Mar. 1973 - 30 Nov. 1974
George S. Hammond 1975 9 p refs
(Grant AF-AFOSR-2506-73; AF Proj. 9538)
(AD-A017616; AFOSR-75-1536TR) Avail: NTIS CSCL 07/3

Five areas of research are covered: (1) the mechanism of production of electronically excited states by gamma rays, (2) the properties of polar fluorescent exciplexes, (3) nonradiative decay processes in the quenching of excited states, (4) some studies of the kinetics of decay of free radicals produced photochemically, and (5) some of our early work in the photochemistry of organometallic compounds. GRA

N76-19262# Florida Univ., Gainesville. Dept. of Chemistry.
GAS PHASE SPECTROMETRY METHODS: TRACE ANALYSIS OF ELEMENTS AND ANALYTICAL GAS PHASE SPECTROMETRY AND COMBUSTION DIAGNOSTICS Final Report
James D. Winefordner Oct. 1975 10 p refs
(Grant AF-AFOSR-2574-74; AF Proj. 9536)
(AD-A017621; AFOSR-75-1537TR) Avail: NTIS CSCL 07/4

The AFOSR program on Gas Phase Spectrometry, Trace Analysis of Elements and Combustion Diagnostics at the University of Florida consists of fundamental, instrumental, methodological and applied studies of atomic and molecular emission and luminescence and atomic and molecular absorption spectrometric methods, particularly as these measurement methods apply to trace element analysis, diagnostics of plasmas, and optimization of spectrometric experimental methods of analysis. By means of such studies, new and improved selection, sensitive, precise, accurate and rapid methods of trace analysis of elements and molecules in the gas phase or convertible to the gas phase have been or are being developed and as an additional bonus valuable diagnostic methods and results for plasmas result. Special efforts have been given to rapid simultaneous or sequential multielement methods of analysis of elements, particularly as applied to the trace analysis of many elements. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-19263 Illinois Univ., Urbana.
A MASS SPECTROMETRIC INVESTIGATION OF TRANSITION METAL COMPLEXES AND AN ELECTRON PARAMAGNETIC RESONANCE STUDY OF SOME EXCHANGE-INTERACTING METALLIC DIMERS AND POLYMERS Ph.D. Thesis

Janine Clare Collard 1975 288 p
Avail: Univ. Microfilms Order No. 76-6731

An investigation was made of the influence of the metal d electronic configruation on the fragmentation patterns of transition metal complexes. Two types of complexes were studied. The first type, the ferric dithiocarbamates, a system exhibiting a spin state equilibrium, affords a series in which the electronic configuration varies as the ligands remain very similar. The second type of complex, the Jager complexes which are square planar Schiff base complexes, is a series in which both the metal, and the substituents around the ligand can be varied. It was found that, indeed, there is a definite influence of the metal d electronic configuration upon the fragmentation of metal complexes. This influence cannot be measured quantitatively as there are many competing factors which influence fragmentation in the mass spectrometer. The EPR of some exchange interacting nickel(2) ions were also investigated. These ions are all six coordinated and interaction occurs through two discrete three-atom bridges such as OCN-SCN-and N3. Dissert. Abstr.

N76-19264 Michigan State Univ., East Lansing.
THE EFFECT OF ACTUAL AND INHERENT AUSTENITE GRAIN SIZE ON IMPACT PROPERTIES OF MEDIUM CARBON STEELS Ph.D. Thesis
Michael Wesley Wisti 1975 154 p
Avail: Univ. Microfilms Order No. 76-5671

The effect of actual and inherent austenite grain size on impact properties was determined for two heats of AISI 1040 and two heats of AISI 1046 steel. All steels were subjected to several austenitizing treatments which varied the grain size from ASTM No. 0 to ASTM No. 10. Impact properties were determined using half-width Charpy V-notch specimens heat treated by air-cooling, or quenching and tempering to hardness of 26-28 rc. Tensile properties were also determined for the quenched and tempered specimens. All quenched and tempered specimens produced impact properties which are excellent for most applications since the highest energy transition temperature was -65 C. Impact properties of air-cooled specimens were extremely sensitive to actual prior austenite grain size. Tensile test results of quenched and tempered specimens showed percent reduction in area slightly improved, or increased 100% in one case, by quenching from actual fine grained austenite. Dissert. Abstr.

N76-19265 Idaho Univ., Moscow.
CAUSE AND PREVENTION OF HEAT TREAT CRACKING OF INCONEL 718 Ph.D. Thesis
Dennis Dale Keiser 1975 225 p
Avail: Univ. Microfilms Order No. 76-4958

Inconel 718 was evaluated for its susceptibility to heat treat cracking, the mechanism behind this type of cracking, and the means that can be taken to prevent this type of cracking. Three heats were investigated by means of elevated temperature tensile tests. Tests were run both in open air and in argon. Test results showed that Inconel 718 can be extremely susceptible to heat treat cracking. This generally occurs when the material is heat treated at 1900 F or above and given a fast cool (1200 F/hr) following the heat treatment at these temperatures. Alloy 718 is susceptible within the temperature range of 1200 to 1600 F, with the minimum ductility occurring at approximately 1450 F. Alloy 718 can be made immune to this type of cracking by slowly cooling the material from elevated temperatures of 1750 F and above. The slow cooling causes agglomeration and enlargement of hardening precipitates which is extremely beneficial. Dissert. Abstr.

N76-19266 Illinois Univ., Urbana.
CRYSTALLOGRAPHY OF THE THERMOELASTIC MARTENSITIC TRANSFORMATION IN Ni-Al ALLOYS Ph.D. Thesis
Sudhansu Chakravorty 1975 198 p
Avail: Univ. Microfilms Order No. 76-6716

The crystallography of the thermoelastic martensitic transformation in Ni-Al alloys is quantitatively studied. The results of experimental analysis of the habit plane, shape strain, and orientation relationship are in very good agreement with the predictions of the Bowles and Mackenzie phenomenological theory. The martensite habit plane normals are close to [2, 14, 15] delta prime poles and are typically clustered in groups of four around each [011] delta prime pole. The shape strain is an invariant plane strain (Delta = 1.0000) and lies almost in the habit plane (92 deg from habit plane normal). The martensite plates in Ni-Al alloys are very regular, with straight habit plane traces. The martensitic transformation in these alloys is thermoelastic and often similar variants of martensite were observed to grow and coalesce into a larger variant upon cooling. Two different variants of martensite often interact and certain characteristic morphologies were also observed. These morphologies are classified as fork type, spear type and overlap type. Interference microscopy proved to be very useful in the study of these mixed morphologies, particularly on a single surface. Dissert. Abstr.

N76-19267 Louisville Univ., Ky.
X-RAY EMISSION STUDIES OF METALLIC HYDRIDES Ph.D Thesis
Vasantha Koppa 1975 127 p
Avail: Univ. Microfilms Order No. 76-6590

Either a protonic or hydridic model has been used to describe the nature of the bonding in group 3b metal hydrides. A variety of experimental results have been interpreted in terms of either model. The recent experimental studies of rare earth hydrides has resolved this controversy of bonding in these compounds to a large extent. The purpose of this investigation was to utilize the results of an X-ray emission study of gadolinium and europium hydrides, not only to provide a direct approach to establishing the nature of the bonding in these hydrides but also to examine whether the results and conclusions drawn here are consistent with the previously published results. Dissert. Abstr.

N76-19268# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIALISTS MEETING ON ALLOY DESIGN FOR FATIGUE AND FRACTURE RESISTANCE
Jan. 1976 170 p refs In ENGLISH partly in FRENCH Presented at 40th Meeting of Struct. and Mater. Panel, Brussels, 13-19 Apr. 1975
(AGARD-CP-185; ISBN-92-835-0151-9) Avail: NTIS HC $6.75

The conference considering the microstructure of aerospace alloys and the associated effects on fatigue and fracture resistance is reported. Aluminum, titanium, and ferrous alloys were considered. For individual titles, see N76-19269 through N76-19274.

N76-19269 McMaster Univ., Hamilton (Ontario). Dept. of Metallurgy and Materials Science.
BASIC MICROSTRUCTURAL ASPECTS OF ALUMINUM ALLOYS AND THEIR INFLUENCE ON FRACTURE BEHAVIOUR
J. D. Embury *In* AGARD Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 13 p refs Sponsored in part by Natl. Res. Council and Defence Res. Board (For availability see N76-19268 10-26)

Factors which determine the scale and distribution of precipitate particles in aluminum alloys and their effects on yield strength are discussed. The influence of coarse intermetallics on fracture, and intergranular fracture are analyzed in terms of strain hardening. F.O.S.

N76-19270 Aluminum Co. of America, Alcoa Center, Pa. Engineering Properties and Testing Div.
DESIGN OF ALUMINUM ALLOYS FOR HIGH TOUGHNESS AND HIGH FATIGUE STRENGTH
J. G. Kaufman *In* AGARD Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 26 p refs (For availability see N76-19268 10-26)

The basic concepts employed in designing fracture-resistant aluminum alloys are reviewed, and specific examples of the application of these concepts are presented in detail. The importance of consideration of strength and stress-corrosion resistance in addition to toughness and fatigue strength is emphasized, and it is pointed out that most successful applications of alloy-design techniques have been in the areas of toughness and stress-corrosion resistance, with little commercial success in the area of fatigue. The roles of interfaces and of various sizes and types of particles in initiating and propagating cracks is examined, and the steps necessary to control the size and

spacing of insoluble constituents and precipitates as well as the grain morphology are discussed. Outstanding examples of the application of microstructural control are aluminum alloys 2048, 2124, 2419, 7050 and 7475, and the specific approaches to their development as well as data illustrating the commercial success are presented. Of the group, 7475 represents the optimum available in the toughness regime, while 7050 provides the best combination of strength, toughness and stress-corrosion resistance of the commercial alloys. Author

N76-19271 Royal Aircraft Establishment, Farnborough (England). Materials Dept.

METALLURGICAL ASPECTS OF FATIGUE AND FRACTURE IN TITANIUM ALLOYS

C. A. Stubbington *In* AGARD Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 19 p refs (For availability see N76-19268 10-26)

The basic features of alpha-beta titanium alloys which result in property anisotropy are the elastic and plastic anistropy of the hexagonal alpha phase, and the sensitivity of their microstructures to thermomechanical processing. Mechanisms of fatigue crack initiation and microstructural requirements for resistance to initiation are discussed. The effect of crystallography on fatigue crack growth is described, and the apparent conflict in microstructural requirements for resistance to fatigue crack initiation and resistance to fatigue crack growth is indicated. It is concluded that in future work, microstructure and texture should be considered simultaneously in relation to fatigue properties, rather than separately, as has largely been the case hitherto. The relationships between microstructure, interstitial content and toughness in titanium alloys are discussed, and the importance of crystallography is highlighted. It is suggested that optimization and control of microstructure, interstitial content, and texture will be required for maximum toughness, and for maximum resistance to stress corrosion and sustained load cracking in alpha-beta alloys. It is also suggested that the approach to the texture parameter could either be to randomize it by heat treatment, or to control it and take advantage of the tough orientations. Maximum directional toughness will be obtained by a combination of microstructural optimization and textural toughening. Author

N76-19272 Rockwell International Corp., Thousand Oaks, Calif. Science Center.

THE EFFECTS OF MICROSTRUCTURE ON THE FATIGUE AND FRACTURE OF COMMERCIAL TITANIUM ALLOYS

N. E. Paton, J. C. Williams, J. C. Chesnutt, and A. W. Thompson *In* AGARD Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 14 p refs (For availability see N76-19268 10-26)

The metallurgy of commercial alpha + beta titanium alloys permits a great variety of microstructures to be obtained. Equivalent strength levels can frequently be obtained in a given alloy with several different microstructures, making it possibble to optimize properties other than strength and modulus by manipulation of microstructure. The effect is discussed of microstructure on fatigue and fracture behavior of two commercial Ti alloys, Ti-6Al-4V and Ti-6Al-2Sn-4Zr-6Mo. Emphasis is placed on fatigue crack growth rate (and corrosion fatigue) properties, and on fracture toughness. The influence of microstructure on secondary properties such as stress corrosion cracking is included where appropriate. In order to illustrate principles important to alloy design concepts, reference is made to work on the effects of microstructure and minor element additions (H and O) to single-phase model Ti alloys. Author

N76-19273 California Univ., Berkeley. Lawrence Berkeley Lab. Inorganic Materials Research Div.

FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF FERROUS ALLOYS

Victor F. Zackay *In* AGARD Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 20 p refs Sponsored in part by ERDA, ONR, AFML and Army Mater. and Mech. Res. Center (For availability see N76-19268 10-26)

The elements of defect structure and microstructure in ultrahigh strength steels that influence the plane strain fracture were studied with emphasis on the austenitizing phase in heat treatment. The austenitizing temperature effects, and the fracture toughness of quenched and tempered steels are discussed along with carbon-free ferrous alloys. F.O.S.

N76-19274 Advisory Group for Aerospace Research and Development, Paris (France).

MECHANICAL PARAMETERS (FATIGUE AND TOUGHNESS) OF CERTAIN VERY HIGH STRENGTH STEEL ALLOYS [CARACTERISTIQUES D'EMPLOI (FATIGUE ET TENACITE) DE QUELQUES ACIERS A TRES HAUTE RESISTANCE]

P. Rabbe and C. Amzallag *In its* Specialists Meeting on Alloy Design for Fatigue and Fracture Resistance Jan. 1976 9 p refs In FRENCH (For availability see N76-19268 10-26)

Investigations were carried out on the following subjects related to certain steel alloys commonly used in aircraft structures: (1) study of the initiation of fatigue cracks, (2) endurance characteristics under tension/compression (Goodman diagram), (3) determination of the critical constraint intensity factor, and (4) graphs of crack propagation speeds. The following specific steels were investigated: 35NCD16, 15CDV6, and Z25NKDV 8-4. The results may be used to rank the various materials in relation to their intended use and also provide quantitative information on acceptable constraint values under service conditions. Author

N76-19275# Los Alamos Scientific Lab., N.Mex.

ANOMALOUS THERMAL PROPERTY BEHAVIOUR OF URANIUM AT LOW TEMPERATURES

T. A. Sandenaw 1975 13 p refs Presented at 5th Intern. Conf. on Plutonium and other Actinides, Baden-Baden, F. R. Ger.

(Contract W-7405-eng-36)

(LA-UR-75-1347; Conf-750915-3) Avail: NTIS HC $4.00

Low temperature heat capacity curves are presented for polycrystalline U235 and U238 metals in different microstructural states and of different purities. Thermal conductivity versus temperature curves are shown for low-purity, polycrystalline U238 in the temperature range between approximately 80 and 373 K for metal having undergone varied fabrication procedures. The influence of impurities on low temperature transitions may be through their effects on dislocation formation. Thermal conductivity and heat capacity runs started at approximately 80 K, after holding specimens at the temperature of boiling liquid nitrogen, do not give results which match up with runs started below 36 to 43 K. Result of measurements started at approximately 80 K indicate that an ordering mechanism is predominating, with microstructure rather than purity being the important factor. This can be explained if ordering at approximately 80 K is through lattice imperfections remaining from prior specimen processing. Author (NSA)

N76-19276# Oak Ridge National Lab., Tenn.

US ADVANCED MATERIALS DEVELOPMENT PROGRAM FOR STEAM GENERATORS

P. Patriarca, S. D. Harkness (Combust. Engineering, Inc.), and J. M. Duke (Westinghouse Elec. Corp., Tampa, Florida) 1975 32 p refs Presented at Intern. Conf. on Materials for Nuclear Steam Generators, Gatlinburg, Tenn., 9 Sep. 1975 Sponsored by ERDA

(Conf-750911-2) Avail: NTIS HC $4.75

The selection of construction materials for LMFBR steam generators is reviewed, presenting the advantages and limitations of 2 1/4 Cr-1 Mo steel selected for the Clinch River Breeder Reactor Plant. These limitations indicate that further development of high strength ferritic steels containing 9 to 12 percent Cr and the high nickel Alloy 800 could lead to superior materials, and programs to develop these materials were started. Experience with high strength ferritic steels was surveyed and ignots of 26 selected compositions were prepared and characterized by Charpy-V notched tests and metallography. A program was set up to provide information required for design, justification, fabrication of reliable components. The role tertiary creep in failure, welding process development, and material characterization progress are discussed. Author (NSA)

N76-19277# Sandia Labs., Albuquerque, N.Mex.

COMPUTATIONAL INVESTIGATION OF THE EFFECTS OF BARRIER LAYERS ON THE PERMEATION OF HYDROGEN THROUGH METALS

W. G. Perkins 1975 10 p refs Presented at Conf. on Effects of Hydrogen on Behavior of Mater., Jackson, Wyoming, 7 Sep. 1975 Sponsored by ERDA
(SAND-75-5126; Conf-750925-2) Avail: NTIS HC $4.00

Results of a computational investigation of the permeation behavior of oxide coated metal membranes are presented. A steady state permeation model was developed which promises to be useful in evaluation of oxide layers on metals as hydrogen permeation barriers. The pressure and thickness dependence of steady state permeation through oxide coated metal membranes is described using plots of logarithmic functions. NSA

N76-19278# Sandia Labs., Albuquerque, N.Mex.
RELATIONSHIP BETWEEN THERMAL EMBRITTLEMENT AND HYDROGEN CRACKING IN 18 Ni(250) MARAGING STEEL
H. J. Rack 1974 12 p refs Presented at Conf. on Effects of Hydrogen on Behavior of Matter., Jackson, Wyoming, 7 Sep. 1975 Sponsored by ERDA
(SAND-75-5159; Conf-750925-5) Avail: NTIS HC $4.00

The role of grain boundary precipitate structure on the stress corrosion susceptibility of 18Ni(250) maraging steel was examined. Varying solution treatment procedures were used to achieve either a precipitate-free grain boundary or one containing a high density of Ti(C,N) particles. The introduction of these treatments, although drastically affecting the monotonic fracture toughness, did not significantly alter the stress corrosion threshold in 100 percent relative humidity. These results are shown to be consistent with the previous suggestion that, under open circuit conditions, hydrogen-assisted cracking controls the environmental crack growth behavior of 18Ni maraging steels. Author (NSA)

N76-19279# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Metall-Lab.
DEVELOPMENT OF THE TECHNOLOGY FOR SUPERPLASTIC ZINC-ALUMINUM ALLOYS Final Report
Wilhelm Brand, Klaus Drefahl, Ulrich Heubner, Karl-Heinz Matucha, Friedrich Petter, Hartmut Sandig, and Ruth Weidemann Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1975 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-16) Avail: NTIS HC $5.00

In order to establish the optimum process parameters for the economic manufacture of large sized superplastic zinc-aluminum sheets, casting and rolling experiments were performed on a laboratory and a pilot scale. The results were transferred to an industrial scale and significant properties of the manufactured sheet investigated. To develop a new technology of superplastic forming, a specially designed thermoforming machine was used to form parts of various shapes. Superplastic zinc-aluminum based alloys with an improved creep strength were developed. Author (ESA)

N76-19280# California Univ., San Diego. Dept. of Physics.
ADATOM DIPOLE MOMENTS ON METALS AND THEIR INTERACTIONS
Walter Kohn and King-Hon Lau Sep. 1975 15 p refs
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-A015633; TR-33) Avail: NTIS CSCL 07/4

An expression is derived for the dipole moment mu, associated with an arbitrary adatom on an arbitrary metal surface, in terms of the differential work done in moving the adatom from the interior of the metal to its actual position in the presence and absence, respectively, of a small, asymptotically uniform electric field on the exterior of the metal. With the aid of this expression it is shown for a jellium metal what the non-oscillatory part of the interaction energy of two dipoles mu(A) and mu(B), situated on the surface and separated by a large distance v, is. This value exceeds by a factor of 2 from the interaction energy of two dipoles in the same relative configuration but in a vacuum. The reason for the difference is that the screening charge of an adatom is delocalized on the metal surface. GRA

N76-19281# Georgia Inst. of Tech., Atlanta. School of Physics.
REFLECTANCE SPECTROSCOPY AND AUGER SPECTROSCOPY OF METALS AND ALLOYS Interim Scientific Report, 1 Oct. 1974 - 1 Jul. 1975
James R. Stevenson 15 Aug. 1975 11 p refs
(Grant AF-AFOSR-2773-75)
(AD-A015710; AFOSR-75-1380TR) Avail: NTIS CSCL 07/4

Optical reflectance studies have been demonstrated to be a valuable tool in probing the mechanisms of corrosion, passivity, and protective coatings on metals and alloys. Although Auger spectroscopy is necessary to characterize the surface, the use of different wavelength intervals to obtain different optical penetration depths is an important consideration in understanding mechanisms taking place in transition layers between the surface and the bulk. Further measurements on the infrared characteristics of synchrotron radiation have shown that the synchrotron provides a valuable source for surface studies in the infrared. The report briefly describes the author's work in this area. GRA

N76-19282# Calspan Corp., Buffalo, N.Y.
RADIATION STUDIES OF METAL-OXYGEN MIXTURES Final Report, 27 Feb. 1974 - 31 Jan. 1975
M. G. Dunn, W. H. Wurster, and C. E. Treanor 1 Aug. 1975 43 p refs
(Contract DNA001-74-C-0220; DARPA Order 1433; DNA Proj. NWER-QAXHI002)
(AD-A017279; CALSPAN-WB-5487-A-1; DNA-3624F) Avail: NTIS CSCL 07/4

Many problems involving the prediction of radiance from heated gases or plasmas containing metals and their oxides are limited in the reliability of their solution because relevant spectroscopic properties of the radiating species are not known. Despite significant recent advances in calculational procedures, many cases still require experimentally based data for reliable inputs to radiance predictions. This is especially true in the infrared spectral range. The purpose of these studies was to provide quantitative spectrometric measurements for metal oxide species in the IR. They are intended to provide a broad data based upon which radiative models may be built for reliable predictions of radiation for a chemical system containing uranium and/or aluminum and oxygen under a variety of environmental conditions. GRA

N76-19283# Albuquerque Univ., N.Mex.
THE ACTIVITY OF TRACE METALS IN AQUEOUS SYSTEMS AND THE EFFECT OF CORROSION CONTROL INHIBITORS Final Report
Rosalie Urzendowski and Arthur H. Guenther Oct. 1975 147 p refs
(Contract F29601-73-C-0110; AF Proj. 8809)
(AD-A017611; AFWL-TR-75-203) Avail: NTIS CSCL 07/4

Water as a dielectric offers many advantages in high energy density electrical storage systems, particularly when pressurized. As part of a continuing research program in high energy density storage research, the water purification system at Kirtland Air Force Weapons Laboratory was monitored in order to determine the electrical and corrosive characteristics of the water and to investigate its use as a dielectric medium for capacitors. The specific conductance, pH, and the analysis of ionic impurities were used as the basis for evaluating the water purity. The principles of metallic corrosion were broadly surveyed with special reference to the controlling factors of immersion and atmospheric corrosion, as well as their application to the prevention of corrosion under service conditions. Extensive measurements were made on various inorganic, polymeric, and organic additives employed in metallic water systems to study their effectiveness in preventing corrosion. For capacitor dielectric systems for which a low conducting dielectric is needed, organic mixtures proved to be the most satisfactory. GRA

N76-19284# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
HYDROGEN EMBRITTLEMENT OF NIOBIUM. 1: MACROSCOPIC BEHAVIOR AT LOW TEMPERATURE
S. Gahr, M. L. Grossbeck, and H. K. Birnbaum Aug. 1975 53 p refs
(Contract N00014-75-C-1012)
(AD-A017035) Avail: NTIS CSCL 11/6

The effect of hydrogen on the ductility of niobium was studied in the temperature range 77 to 300K. Tension testing and detailed fractographic studies were used to establish the roles of hydrogen concentration, temperature, yield stress and strain

rate in the fracture process. It was shown that two ductility minima can be observed in the temperature range examined and that these are related to the precipitation of hydrides during the deformation process. The fracture mode is cleavage in the temperature range of both ductility minima. The solid solution of H in Nb was shown to be a highly ductile alloy; the ductility being terminated by the formation of a stress induced hydride which exhibits cleavage. GRA

N76-19285# Battelle Columbus Labs., Ohio.
INFLUENCE OF MICROSTRUCTURE AND SECOND PHASES ON FRACTURE TOUGHNESS Final Technical Report, 1 Jun. 1971 - 31 May 1974
G. T. Hahn, C. R. Barnes, and A. R. Rosenfield Jun. 1975 122 p refs
(Contract F33615-71-C-1915; AF Proj. 7021)
(AD-A017547; ARL-75-0194) Avail: NTIS CSCL 11/6

The microstructure, second phases, and micromechanisms contributing to fracture toughness of AISI 4340 steel, maraging steel, Ti-6Al-4V, and 7000-series aluminum alloys are examined. The study focuses on high strength alloys and the component of toughness arising from strain localization and shear rupture, which is shown to be related to the 'plane strain' ductility. Methods of measuring plane strain ductility are examined, and a new double-bend method which can be applied to both plate and sheet coupons is devised. Successive replicas of the bend specimen surface are used to follow the development of slipping regions and cracks under 'plane strain' biaxial loading, and to measure slip offsets. The alloys display a tendency for a more coordinated slipping of neighboring grains under 'plane strain' flow leading to strain localization: (a) the formation of coplanar arrays of slip bands or sliding grain boundaries called 'superbands', (b) the growth of superbands which can accommodate large shears, (c) initiation of shear microcracks within the bands, and (d) the linking of the cracks into a macrocrack. The susceptibility to strain localization and shear rupture is traced to a number of microstructural elements, including (a) fine, coherent precipitate particles cut by dislocations, (b) inclusions, and (c) the grain size and character of the grain boundaries.
Author (GRA)

N76-19286# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
HIGH TOUGHNESS TITANIUM ALLOY DEVELOPMENT Final Technical Report, Apr. 1974 - Jul. 1975
R. G. Berryman, F. H. Froes, J. C. Chesnutt, C. G. Rhodes, and J. C. Williams Jul. 1975 112 p
(Contract N00019-74-C-0273)
(AD-A017452; TFD-75-640) Avail: NTIS CSCL 11/6

This is the final engineering report for a Naval Air Systems Command sponsored program to develop new titanium alloys for aircraft applications. During the first of the two phases in this effort, four thermomechanical processing/final heat treatment sequences were evaluated for each alloy. Evaluations at the conclusion of this phase revealed that mechanical properties of three of the four process conditions investigated for Ti-5Mo-4. 5Al-1.5Cr met or exceeded the high toughness/moderate strength goal, indicating good reproducibility of these properties over a wide range of processing conditions. On the other hand, mechanical properties of the alloy designed to meet the moderate toughness goal at high strength levels, Ti-8Mo-2. 5Al-4. 5Cr, fell short of those goals. Because of a real need to develop an alloy of this type, particularly for forging applications, the second phase of this effort was concentrated on further development of this latter alloy. GRA

N76-19287# Goodrich (B.F.) Engineered Systems Co., Akron, Ohio.
INVESTIGATION OF WHITE, THERMALLY-STABLE, RAIN EROSION RESISTANT PROTECTIVE MATERIALS Final Report, 21 Mar. 1973 - 15 May 1975
Robinson F. Nichols 23 May 1975 35 p
(Contract N00019-73-C-0275)
(AD-A017478; BFG-75-23-025) Avail: NTIS CSCL 11/3

An investigation was conducted to develop a heat-resistant white compound for use as a rain erosion protective material. Using a black EPR compound with a peroxide cure system as the starting point, white pigments to replace the carbon black were evaluated. These pigments were evaluated for color, effect on rain erosion, and electrical properties. From the pigments evaluated, zinc oxide and titanium dioxide were selected for extensive testing to determine the optimum quantities to be used. Compounds containing zinc oxide provided the best erosion resistance - in excess of 50 minutes when tested at 500 mph in 1 inch/hour rainfall-and dielectric properties. At 8.4G Hz the dielectric constant was 2.49 and the loss tangent was .0155. However all compounds evaluated had poor heat resistance. The heat resistance was significantly improved with the addition of Antioxidant MB such that practically no reduction in physical properties occurred after 24 hours at 350F. Therefore, an EPR compound containing zinc oxide as the principal white pigment and having Antioxidant MB will provide a suitable heat-resistant white rain erosion protective material. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-19288 Illinois Univ., Urbana.
PRESSURE-TEMPERATURE NMR STUDIES OF POLYMER AND DISORDERED CRYSTALLINE SYSTEMS Ph.D. Thesis
William Christopher Allen 1975 194 p
Avail: Univ. Microfilms Order No. 76-6679

Three types of motion occurring within the solid state of matter were investigated using nuclear magnetic resonance techniques regarding their pressure-temperature sensitivities. These motions were molecular self diffusion, overall molecular reorientation, and internal molecular reorientation. An activation model was employed to describe the molecular dynamics. The physical systems investigated were those of polymers and plastic crystals. The effects of the pressure-induced phase transformation and dynamic changes accompanying the transition were studied. The plastic crystals investigated were neopentane, cyclohexane, and hexamethyldisilane. The polymer systems studied included crystalline and amorphous teflon. The dynamic behavior of neopentane was investigated according to its spin lattice relaxation times. In the high temperature phase this system exhibits self diffusive and molecular tumbling features. Dissert. Abstr.

N76-19289# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
POLYMER THEORY FOR MOLTEN SLAGS
O. A. Esin 1976 23 p refs Transl. into ENGLISH from Fiz.-Khim. Issled. Protsessov (USSR), no. 1, 1973 p 5-17
(NRC/CNR-TT-1851; ISSN-0470-2557) Avail: NTIS HC $3.50

Polymer theory is applied to molten silicates in order to describe the complex behavior of a large number of different structures of anions. Author

N76-19290# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
FRACTURE, STATIC FATIGUE, AND REACTIONS OF WATER WITH GLASS Final Report, 1 Sep. 1971 - 31 Aug. 1975
R. H. Doremus Oct. 1975 9 p refs
(Contract N00014-67-A-0117-0014; NR Proj. 032-531)
(AD-A016656) Avail: NTIS CSCL 11/2

The main aim of this project has been to learn more about the fracture of glass, particularly as it is affected by reactions with atmospheric water that are accelerated by tensile stress. Delayed failure of soda-lime glass and a glass ceramic were studied in detail, leading to a new theory of static fatigue in glass and discovery of the only known oxide showing no static fatigue. Crack lengths were measured by a new etching technique, which also provided a measure of the crack tip radius and an experimental test of the Griffith Fracture Equation. A discussion of criteria for brittle fracture developed from this work. GRA

N76-19291# Hawaii Inst. of Geophysics, Honolulu.
PRESSURE AND TEMPERATURE STUDIES OF GLASS

PROPERTIES RELATED TO VIBRATIONAL SPECTRA Final Report, 1 Feb. 1971 - 31 Dec. 1974
Murli H. Manghnani Dec. 1974 143 p refs
(Contract N00014-67-A-0387-0012; NR Proj. 032-527)
(AD-A016802; HIG-74-11) Avail: NTIS CSCL 11/2

This report concerns the M2O-SiO2 and SiO2-TiO2 glass systems. Elastic, thermal and infrared absorption characteristics of nineteen simple binary M2O-SiO2 glasses, where M is Li, Na or K, have been studied at ambient conditions as well as function of pressure and temperature. M2O content of these glasses ranges from 10 to 45 mole %. Elastic moduli were investigated to 5 kbar and to 300 C, thermal expansivity to 300 C, and infrared absorption to 58.8 kbar. The elastic properties of the M2O-SiO2 glasses vary systematically with composition. Addition of M2O to SiO2 structure causes increase in bulk modulus of all the glasses, decrease in shear and Young's moduli of all but the Li2O-SiO2 glasses, and increase in Poisson's ratio. Low M2O glasses show anomalous elastic behavior under pressure. Effect of phase separation on the elastic properties is not significant; however, their temperature dependence is sensitive to phase separation. Ultrasonic longitudinal and shear wave attenuation are found to be linearly proportional to frequency. The low-temperature attenuation peak found in fused silica at approximatley 47 K broadens and shifts to higher temperature with increase in M2O content. GRA

N76-19292# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
EQUILIBRIUM PENNY LIKE CRACK IN INDENTATION FRACTURE Final Report, 1 Jul. 1974 - 30 Jun. 1975
B. R. Lawn and E. R. Fuller Sep. 1975 29 p refs Sponsored in part by Office of Naval Res., Arlington, Va.
(COM-75-11461/1; NBSIR-75-730) Avail: NTIS HC $4.00 CSCL 11B

The mechanics are studied of two basic types of indentation fracture, cone cracks (blunt indenters) and median cracks (sharp indenters). The common feature which forms the central theme is that both crack types, in their well-developed stages of growth, may be regarded as essentially "peny-like". One this basis a universal similarity relation is derived for equilibrium crack dimension as a function of indentation load. Experimental measurements confirm the general form of this relation. A more detailed fracture mechanics analysis is then given, to account for additional, contact variables evident in the data. GRA

N76-19293# Rock Island Arsenal Lab., Ill. Thomas J. Rodman Lab.
ENVIRONMENTAL EXPOSURE AND ACCELERATED TESTING OF RUBBER-TO-METAL VULCANIZED BONDED ASSEMBLIES Technical Report, Jul. 1972 - Jun. 1974
John A. Williams Nov. 1974 24 p
(DA Proj. 1T1-62105-AH-48)
(AD-A017368; RIA-R-TR-75-013) Avail: NTIS CSCL 11/10

The purpose of this work is to expose rubber-to-metal vulcanized bonded assemblies to environmental conditions experienced by weapon components in the field and to determine the effect of this exposure on the vulcanized bond. The purpose is also to duplicate these long term environmental effects with an accelerated laboratory test. Four different groups of rubber-to-metal vulcanized bonded assemblies were exposed outdoors in Panama and at Rock Island. Accelerated laboratory testing was conducted using heat and humidity. After one year exposure in Panama; the butadiene acrylonitrile rubber bonded assemblies showed a severe loss of 100 percent in bond strength; the EPDM bonded assemblies showed a 40 percent loss in bond strength and the SBR and neoprene bonded assemblies showed no loss in bond strength. Accelerated testing did show the same results as environmental exposure, but laboratory test periods (up to 56 days) are too long for a good accelerated test. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-19294# Southwest Research Inst., San Antonio, Tex.
LIGHT-INITIATED EXPLOSIVES RESEARCH Final Report
R. L. Bessey Jan. 1976 40 p refs
(SwRI Proj. IR-02-9108-001)
Avail: NTIS HC $4.00

Light emission characteristics of the sources used to produce light-initiated blast loading were examined with emphasis on the time dependence of the spectrally integrated irradiance at some fixed distance from the various types of light sources which might be used to detonate silver acetylide-silver nitrate (SASN). An apparatus for measuring irradiance from a non steady state light source was developed and calibrated. A text matrix was run for a number of different types of light sources, and a number of different techniques for source initiation were tried. The character was studied of the blast loading produced by using SASN as an initiator for a secondary explosive, using tamped SASN, or using various types of light sources to initiate the SASN. Results of these investigations and some of the methods used to obtain them are reported. Author

N76-19295# Advisory Group for Aerospace Research and Development, Paris (France).
FUTURE FUELS FOR AVIATION
I. I. Pinkel (Pinkel, I. Irving, Consultant, Fairview Park, Ohio) Jan. 1976 41 p
(AGARD-AR-93; ISBN-92-835-1201-4) Avail: NTIS HC $4.00

The fuel supply outlook within the NATO nations is considered. Hydrocarbon fuels, alternate fuels as well as specification changes for fuels and changes in aircraft design and operation are discussed. Recommendations for future programs are included. Author

N76-19296*# Southwest Research Inst., San Antonio, Tex.
WORKBOOK FOR PREDICTING PRESSURE WAVE AND FRAGMENT EFFECTS OF EXPLODING PROPELLANT TANKS AND GAS STORAGE VESSELS
W. E. Baker, J. J. Kulesz, R. E. Ricker, R. L. Bessey, P. S. Westine, V. B. Parr, and G. A. Oldham Nov. 1975 558 p refs
(Contract NAS3-19231)
(NASA-CR-134906; Rept-02-4130) Avail: NTIS HC $13.50 CSCL 21I

Technology needed to predict damage and hazards from explosions of propellant tanks and bursts of pressure vessels, both near and far from these explosions is introduced. Data are summarized in graphs, tables, and nomographs. For individual titles, see N76-19297 through N76-19302.

N76-19297* Southwest Research Inst., San Antonio, Tex.
ESTIMATES OF EXPLOSIVE YIELD
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellant Tanks and Gas Storage Vessels Nov. 1975 23 p refs (For availability see N76-19296 10-28) CSCL 21I

Explosive yield as a function of propellant type and accident conditions was discussed along with the characteristics of propellant explosions. Three types of fuel-hypergolic, liquid oxygen-hydrocarbon, and liquid oxygen-liquid-hydrogen were considered. Data are also given on three modes (failure modes) of mixing: confinement by missile, confinement by ground surface, and high velocity impact. E.H.W.

N76-19298* Southwest Research Inst., San Antonio, Tex.
CHARACTERISTICS OF PRESSURE WAVES
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellant Tanks and Gas Storage Vessels Nov. 1975 49 p refs (For availability see N76-19296 10-28) CSCL 21I

Air blast characteristics generated by most types of explosions

are discussed. Data cover both negative and positive blast load phases and net transverse pressure as a function of time. The effects of partial or total confinement, atmospheric propagation, absorption of energy by ground shock or cratering, and transmission over irregular terrain on blast wave properties were also considered. E.H.W.

N76-19299* Southwest Research Inst., San Antonio, Tex.
EFFECTS OF PRESSURE WAVES
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellant Tanks and Gas Storage Vessels Nov. 1975 11 p refs (For availability see N76-19296 10-28) CSCL 21I

Two parameters, side on overpressure and side on impulse loads, and their application to the determination of structural damage to buildings and vehicles in the vicinity of an explosion are investigated. Special consideration was given to what constitutes damage and what level of damage is acceptable. Solutions were sorted through the examination of glass breakage, curve fit to bomb damage, overturning of marginal structures (buses, trucks, mobile homes) subject to toppling, and initiation of yielding in either beam or plate structural components. Three different empirical pressure versus impulse diagrams were presented - the first is for minor structural damage involving wrenched joints and partitions, the second is for major damage structural damage with load bearing members at least partially destroyed, and the third is for 50% to 75% of the building demolished. General guidelines were obtained from the results when the accurate structural details are unknown. E.H.W.

N76-19300* Southwest Research Inst., San Antonio, Tex.
CHARACTERISTICS OF FRAGMENTS
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellant Tanks and Gas Storage Vessels Nov. 1975 234 p refs (For availability see N76-19296 10-28) CSCL 21I

Methods used to estimate initial fragment velocities from various types of accidental explosions, geometry of vessel, or explosion source are reported. In addition, fragmentation ranges and impact conditions, using initial velocities as inputs, are discussed. Several classes of accidental explosions and fragment mass distribution predicted by statistical methods are included. Computer program techniques are summarized. E.H.W.

N76-19301* Southwest Research Inst., San Antonio, Tex.
EFFECTS OF FRAGMENTS
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellant Tanks and Gas Storage Vessels Nov. 1975 33 p refs (For availability see N76-19296 10-28) CSCL 21I

Methods used to determine structural damage caused by fragments from accidental explosions are outlined. Structures considered include launch facilities for liquid propellant rockets and metal plates and sheets. Penetrating and nonpenetrating fragments were considered. E.H.W.

N76-19302* Southwest Research Inst., San Antonio, Tex.
RISK ASSESSMENT AND INTEGRATED EFFECTS
In its Workbook for Predicting Pressure Wave and Fragment Effects of Exploding Propellants Tanks and Gas Storage Vessels Nov. 1975 50 p refs (For availability see N76-19296 10-28) CSCL 21I

The systematic, effective approach required to identify the type, magnitude, and probability of occurrence of undesired events in the operation of any given system is discussed. Three basic related systematic methods are employed, either singly or in combination, to accomplish these types of analyses. These methods are: event tree, fault tree, and failure mode effects and criticality analysis. Author

N76-19303# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
INVESTIGATION OF DETONATION CHAINS. DETERMINATION OF INITIATION TIMES USING A CONTINUOUS MEASURING WIRE [ONDERZOEK DETONATIEKETENS. DE BEPALING VAN INITIATIETIJDEN MET BEHULP VAN DE CONTINUE MEETDRAAD]
A. A. Schilperoord 15 Sep. 1974 24 p refs In DUTCH
(Contract A70/KL/058)
(TL-1974-23; TDCK-65416) Avail: NTIS HC $3.50

The possibility of using a measuring wire, developed for measuring detonation velocities, for the determination of detonation initiation times of explosives, the initiation being caused by shockwaves, was investigated. Pressed, powered, and cast explosives were studied. It is shown that a qualitative impression of initiation times can be obtained from measuring wire experiments, the results being better if the wire has a better contact with its surroundings. ESA

N76-19304# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
CORRELATION OF P SUB max AND v SUB O WITH CLOSED BOMB TESTS. ELEMENTARY INTERNAL BALLISTICS COMPUTER PROGRAMS [CORRELATIE P SUB max EN v SUB O MET GESLOTEN BOMPROEVEN. ELEMENTAIRE INWENDIG BALLISTISCHE REKENPROGRAMM'S]
P. M. VanDenBroecke and A. Schenk 8 Nov. 1974 32 p refs In DUTCH
(Contract A72/KL/097)
(TL-1974-24; TDCK-65565) Avail: NTIS HC $4.00

Two internal ballistics computer programs, called ICLVES and IBVM2, are described. With these programs the combustion properties of weakly smoking gunpowder and the velocity of the projectile when leaving the muzzle can be predicted from results of the closed bomb tests. The listings of the FORTRAN programs are given. ESA

N76-19305# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
STEADY STATE BEHAVIOR OF HYDRAZINE CATALYTIC THRUSTERS Interim Report, 1 Jan. - 31 Dec. 1974
A. Crespo, E. Fraga, and A. Munoz 16 Jul. 1975 25 p refs (Grant AF-AFOSR-2253-72; AF Proj. 6813; AF Proj. 9711)
(AD-A015852; AFOSR-75-1238TR; IR-3) Avail: NTIS CSCL 07/4

A theoretical analysis is described by means of which temperatures and concentrations are calculated along a chamber where hydrazine decomposes catalytically. The corresponding results have to be calculated numerically. A single nondimensional parameter seems to be the only one needed to describe the main characteristics of the problem. Of particular interest is the results that the maximum temperature is reached at a certain distance that expressed in non-dimensional variables seems to vary little in a wide range of operating conditions, this allows to find a close expression for the value of this distance. Comparisons have been carried out with the results of some experiments made at INTA. GRA

N76-19306# Aerojet Solid Propulsion Co., Sacramento, Calif.
FLEXIBLE CASE-GRAIN INTERACTION IN BALLISTIC WEAPON SYSTEMS. PART 1: RECOVERY OF STRAIN INDUCED DAMAGE IN ANB-3066 PROPELLANT. PART 2: VISCOELASTIC CHARACTERIZATION OF A NONLINEAR GLASS/EPOXY COMPOSITE INCLUDING THE EFFECTS OF DAMAGE Special Technical Report, May 1972 - Dec. 1974
Richard J. Farris and Scott W. Beckwith (Texas A and M Univ., Coll. Station) Edwards AFB, Calif. AFRPL May 1975 212 p refs
(Contract F04611-72-C-0055; AF Proj. 3059)
(AD-A015841; ASPC-1953-81SR-2-Pt-1/2; AFRPL-TR-75-11-Pt-1/2) Avail: NTIS CSCL 21/9

In part one, experimental evaluations of previous strain and recovery histories were conducted to determine their influences upon subsequent mechanical property characterizations of solid propellant grains. The purpose of the tests was to determine the effects of motor pressurization and thermal strains. Based on the experimental data contained in this report it is recommended that large propellant blocks from the dissected motor be stored stress-free at room temperature for a period of at least one month. In part two isothermal creep and recovery tests were conducted on an epoxy resin and a glass fiber-reinforced composite made from the same bulk resin. Both the epoxy and glass/epoxy were found to be thermorheologically complex materials with a creep compliance which may be represented by a power law in time. GRA

N76-19307# Stanford Research Inst., Menlo Park, Calif.
STUDIES OF HOMOGENEOUS AND HETEROGENEOUS HYDRAZINE DECOMPOSITION FOR MONOPROPELLANT PROPULSION SYSTEMS Annual Report, 1 Jun. 1974 - 31 May 1975
S. W. Benson, J. L. Falconer, D. M. Golden, S. E. Stein, and H. Wise 25 Jul. 1975 72 p refs
(Contract F44620-73-C-006; SRI Proj. PYU-2716; AF Proj. 9711)
(AD-A015902; AFOSR-75-1373TR) Avail: NTIS CSCL 07/4

The overall objective of this study is the elucidation of the gradual activity decay exhibited by hydrazine fuel thrusters operating in a pulse mode and using granular-supported iridium catalysts (Shell-405). The report describes surface studies on Shell-405 catalyst by temperature-programmed desorption, surface-area titration, and Auger electron spectroscopy which point to a loss in active surface area of iridium caused by crystallite sintering and accumulation of surface impurities following exposure to hydrazine. The heterogeneous decompositon kinetics point to a reaction order of 1/2 on silica surfaces and of unity on Shell-405 catalyst. The products of decomposition are temperature dependent. These results provide some insight into the causes of catalyst deactivation resulting from surface changes of the active metal component of Shell-405 catalyst, i.e., the iridium crystallites. GRA

N76-19308# Naval Weapons Support Center, Crane, Ind.
A MATHEMATICAL MODEL OF FLARE PLUME COMBUSTION AND RADIATION Final Report, 1 Jul. 1972 - 30 Jun. 1974
John E. Tanner, Jr. 30 Jun. 1975 86 p refs
(AD-A015629; NWSC/CR/RDTR-9) Avail: NTIS CSCL 07/4

A mathematical model of combustion and radiation in the plume of a pyrotechnic flare was constructed based on observations and on relevant radiation and thermodynamic theory. The model is applied to specific cases by means of computer program which computes the equilibrium thermodynamic properties and the radiation rates at closely spaced points from the flare surface, where combustion begins, to the tail of the plume where radiation is essentially zero. The calculations indicate that in real flares a significant amount of air augments combustion and that this air has a large effect on flame temperature and on luminous output. The smoke is found to emit as a weak graybody. Burning times for the magnesium particles are indicated. When appropriate theoretical and experimental input data are supplied, the program should be useful for predicting output from new formulas giving radiation in a large number of wavelengths or wavelength bands. Specifically, the model should be useful for formulating colored flares and infrared flares. The computer program used is described. GRA

N76-19309# Massachusetts Univ., Amherst.
STUDY OF GAS PHASE IGNITION MECHANISM WITH SKIMMING TRANSIENT MASS SPECTROSCOPY Final Report
Karl Jankus 1 Sep. 1975 9 p refs
(Grant DA-ARO(D)-31-124-72-G142)
(AD-A017285; ARO-10511.1-C) Avail: NTIS CSCL 07/4

A series of pyrolysis experiments have been performed on ammonium perchlorate (AP) ranging from low temperature solid phase decomposition to high heating rate (10 C/sec) flash evaporation. The aim of these experiments was to study the effects of gas phase reactions and to determine the nature of AP pyrolysis at heating rates that are representative of actual propellant systems. All experiments were performed with the use of transient mass spectroscopy. GRA

N76-19310# Picatinny Arsenal, Dover, N.J.
S-TRINITROBENZENE AS A BINDER IN COMPRESSION-MOLDED EXPLOSIVE COMPOSITIONS
Franklin B. Wells Nov. 1975 19 p refs
(AD-A017071; PA-TR-4783) Avail: NTIS CSCL 19/1

Cycletetramethylenetetranitramine HMX s-trinitrobenzene (TNB) ratios and loading parameters required to provide compression-molded HMX/TNB articles that approach the theoretical maximum density (TMD) were established. It was also shown that the HMX used need not be very fine-grained. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-19311 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MEASUREMENT OPTIMIZATION Ph.D. Thesis
Harold D. Shoemaker 1975 98 p
Avail: Univ. Microfilms Order No. 76-6506

A methodology is developed for determining the optimum measurement strategy for processes which can be represented by linear, discrete plant and measurement equations. The optimum values of the observation matrices are determined by minimizing a cost function which contains a quadratic form of the observation matrices. The class of problems considered is referred to as combined optimization problems whose solution requires the determination of the best estimate of the state, the optimum plant control and the optimum observation control. The plant equation is linear in the state and plant control, and contains an additive white Gaussian noise term. The measurement equation is linear in the state and contains additive white Gaussian noise. The cost function to be minimized is quadratic in the state and plant control, and contains a scalar valued quadratic form of the observation matrix. Dissert. Abstr.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-19312 Massachusetts Univ., Amherst.
SIGNAL TRANSMISSION OVER CHANNELS WITH TIME-VARYING RANDOM DELAYS Ph.D. Thesis
Mario Alberto Blanco 1975 224 p
Avail: Univ. Microfilms Order No. 76-5313

Many communication channels can best be studied when they are modeled as linearly time varying systems, such that their impulse response is itself a random process. An important class of such channels that having pure delay is considered, and the problem of signal transmission over such channels is analyzed. In a pure delay channel the input signal suffers a time varying and possibly random delay on passage from the transmitter to the receiver such that an impulse applied at time t produces a weighted impulse at the output at time t+theta(t), where theta(t) is a delay function which characterizes the channel completely. Several important applications are found in satellite communications, tropospheric scatter, radar and sonar systems, random path networks, speaker recognition studies, etc. These systems can be modelled as pure delay channels. Dissert. Abstr.

N76-19313# Australian Post Office Research Labs., Melbourne.
A COMPACT ELECTRIC FIELD STRENGTH REFERENCE SYSTEM FOR LABORATORY USE
O. Lobert and V. K. Sargeant Mar. 1974 17 p refs
(Rept-6808) Avail: NTIS HC $3.50

The development and calibration is described of an electric field strength reference system in the V.H.F. range (150 MHZ band) which enables the limiting (maximum) sensitivity of miniature radio receivers such as paging receivers (telefinders) to be determined in the laboratory. Author

N76-19314*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
APPLICATION OF LSI TO SIGNAL DETECTION: THE DELTIC DFPCC Contractor Report
J. D. Gassaway and R. J. Whelchel 12 Jan. 1975 112 p refs
(NASA-CR-144194) Avail: NTIS HC $5.50 CSCL 17B

The development of the DELTIC DFPCC serial mode signal processor is discussed. The processor is designed to detect in the presence of background noise a signal coded into the zero

crossings of the waveform. The unique features of the DELTIC DFPCC include versatility in handling a variety of signals and relative simplicity in implementation. A theoretical performance model is presented which predicts the expected value of the output signal as a function of the input signal to noise ratio. Experimental results obtained with the prototype system, which was breadboarded with LSI, MSI and SSI components, are given. The device was compared with other LSI schemes for signal processing and it was concluded that the DELTIC DFPCC is simpler and in some cases more versatile than other systems. With established LSI technology, low frequency systems applicable to sonar and similar problems are feasible. Author

N76-19315*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
GEOS-C COHERENT C-BAND TRANSPONDER TEST PROCEDURE FOR SPACECRAFT LEVEL TESTS
A. R. Selser Aug. 1973 31 p
(NASA-TM-X-69362; TK-6340-77) Avail: NTIS HC $4.00 CSCL 17B

Procedures for the performance of two tests (electrical and airlink) for the transponder are outlined. The C-band test console used in performing the above tests is described (circuit diagrams and block diagrams), and equipment specifications are given. Calibration of the test equipment is also discussed. J.R.T.

N76-19316*# Aerojet Electrosystems Co., Azusa, Calif.
DEVELOPMENT OF THE MULTISPECTRAL ACTIVE/PASSIVE MICROWAVE IMAGING SYSTEM
D. McDonald, A. Stogryn, and W. Bennet Mar. 1976 269 p refs
(Contract NAS1-13230)
(NASA-CR-144907) Avail: NTIS HC $9.00 CSCL 17I

The development and testing of a multifrequency mechanically scanned reflector antenna are described and the definition and preliminary design of a multifrequency airborne meteorological radar are presented. Author

N76-19317*# RCA Corp., Princeton, N.J. Astro-Electronics Div.
SOLID STATE TELEVISION CAMERA Final Report
Feb. 1976 102 p
(Contract NAS9-14477)
(NASA-CR-147494) Avail: NTIS HC $5.50 CSCL 17B

The design, fabrication, and tests of a solid state television camera using a new charge-coupled imaging device are reported. An RCA charge-coupled device arranged in a 512 by 320 format and directly compatible with EIA format standards was the sensor selected. This is a three-phase, sealed surface-channel array that has 163,840 sensor elements, which employs a vertical frame transfer system for image readout. Included are test results of the complete camera system, circuit description and changes to such circuits as a result of integration and test, maintenance and operation section, recommendations to improve the camera system, and a complete set of electrical and mechanical drawing sketches. Author

N76-19318*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC TRANSPONDER Patent Application
Roy E. Anderson (GE, Schenectady, N. Y.) and James R. Lewis, inventors (to NASA) (GE, Schenectady, N. Y.) Filed 27 Mar. 1976 23 p Sponsored by NASA
(NASA-Case-GSC-12075-1; US-Patent-Appl-SN-562499) Avail: NTIS HC $3.50 CSCL 17B

A method and apparatus for the automatic, remote measurement of the internal delay time of a transponder at the time of operation is provided. A small portion of the transmitted signal of the transponder is converted to the receive signal frequency of the transponder and supplied to the input of the transponder. The elapsed time between the receive signal locally generated and the receive signal causing the transmission of the transmitted signal is measured, said time being representative of or equal to the internal delay time of the transponder at the time of operation. NASA

N76-19319# Marine Elektronisch Bedrijf, Oegstgeest (Netherlands). Afdeling Meettechniek.
EVALUATION OF NAVIGATION RECEIVER NX 1A. MAKE SERCEL [EVALUATIE NAVIGATIE-ONTVANGER NX 1A. FABRIKAAT SERCEL]
J. Olk Nov. 1973 19 p In DUTCH
(ETG-1606) Avail: NTIS HC $3.50

A technical evaluation was carried out for the navigation receiver NX 1A, manufactured by Sercel. The receiver operates at 10.2 and 13.6 kHz, according to the Omega navigation system. The measurements deviate from the specifications, but phase measurements with a simulated Omega signal show that the receiver functions well. ESA

N76-19320# Marine Elektronisch Bedrijf, Oegstgeest (Netherlands). Afdeling Meettechniek.
EVALUATION OF NAVIGATION RECEIVER MODEL 700 AND RECORDER/POWER PACKAGE MODEL 700 RP. MAKE TRACOR [EVALUATIE NAVIGATIE-ONTVANGER MODEL 700 EN RECORDER/POWER PACK MODEL 700 RP. FABRIKAAT: TRACOR]
J. Olk Nov. 1973 20 p In DUTCH
(ETG-1608) Avail: NTIS HC $3.50

A technical evaluation was carried out for the navigation receiver model 700 and the recorder/power pack model 700 RP manufactured by Tracor. The receiver operates at 10.2 and 13.6 kHz according to the Omega navigation system. The equipment was found to be less good from the point of view of navigation, reading accuracy, and operation, and also requires a long antenna. The antenna filter was only adapted to 10.2 kHz. Phase measurements showed further errors. ESA

N76-19321# Coast Guard Research and Development Center, Groton, Conn.
STATISTICS ON BRIDGE-TO-BRIDGE FREQUENCY USAGE AT SELECTED SITES IN THE EIGHTH COAST GUARD DISTRICT Final Report
J. A. McIntosh and L. B. Brown Apr. 1975 73 p
(AD-A015931; CGR/DC-8/75; USCG-D-93-75) Avail: NTIS CSCL 17/2

Equipment was assembled and tested to record the time of occurrence and the duration of transmissions on the vessel bridge-to-bridge radio frequency, VHF-FM Channel 13. The input to this equipment was provided by magnetic tape recordings previously obtained at each site over a 24 hour period or by directly connecting the equipment to a VHF-FM monitor receiver. Message length histograms indicated that about 50 percent of all transmissions were of less than 3 seconds in duration and that about 95 percent of all transmissions were of less than 10 seconds in duration. The sites for which data was obtained include Port Allen, New Orleans, Harvey Locks, Venice, Houma, Berwick, Berwick Locks, and Intercoastal City, LA, and Galveston, Port Arthur and Orange, TX. GRA

N76-19322# Coast Guard Research and Development Center, Groton, Conn.
STATISTICS ON BRIDGE-TO-BRIDGE FREQUENCY USAGE AT SELECTED SITES IN THE THIRD COAST GUARD DISTRICT Final Report
J. A. McIntosh and L. B. Brown May 1975 45 p
(AD-A015936; CGR/DC-10/75; USCG-D-100-75) Avail: NTIS CSCL 17/2

Equipment was assembled and tested to record the time of occurrence and the duration of transmissions on the vessel bridge-to-bridge radio frequency, VHF-FM Channel 13. The input to this equipment was provided by magnetic tape recordings previously obtained at each site over a 24 hour period or by directly connecting the equipment to a VHF-FM monitor receiver. Message length histograms indicated that about 50 percent of all transmissions were of less than 3 seconds in duration and that about 95 percent of all transmissions were of less than 10 seconds in duration. The sites for which data was obtained include Governor's Island; Fort Schuyler, NY; Sandy Hook, NJ; Cape Henlopen; The C and D Canal; Philadelphia Naval Shipyard; Eatons Neck, NY; New Haven and Groton, CT. GRA

N76-19323# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A SIMULATION APPROACH TO DETERMINE COMMUNICATIONS MAINTENANCE MAN POWER REQUIRE-

MENTS M.S. Thesis
Donald W. Klovstad and Ronald M. Rhodes Aug. 1975 210 p refs
(AD-A016269; SLSR-10-75B) Avail: NTIS CSCL 05/9

The Logistics Composite Model (L-COM), jointly developed by the Air Force Logistics Command and the Rand Corporation, was designed to address aircraft operations, maintenance and support concepts. Also, L-COM is a validated simulation model that represents aircraft operations and the resulting demands for resources. Using maintenance as the key link between aircraft operations and communications, the authors theorized that the operations of a base communications maintenance system is similar in many ways to the operation of an aircraft maintenance system. After reviewing both maintenance operations (aircraft and communications) the authors constructed communication maintenance models within the framework of the Logistics Composite Model. The communication models that were constructed, after testing, indicated that L-COM could be modified to realistically represent an Air Force communications system.
GRA

N76-19324# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE TERMINAL INTERFACE MESSAGE PROCESSOR PROGRAM
Sep. 1975 222 p refs
(Contracts DAHC15-69-C-0179; F08606-73-C-0027)
(AD-A016281; Tech-Inform-91) Avail: NTIS CSCL 09/2

Because the terminals connected to a TIP communicate with Hosts at remote sites, the TIP, in addition to performing the IMP function, also acts as intermediary between the terminal and the distant Host. This means that network standards for format and protocol must be implemented in the TIP. One can thus think of the TIP software as containing both a very simpleminded mini-Host and a regular IMP program. GRA

N76-19325# Mission Research Corp., Santa Barbara, Calif.
EMP INDUCED HIGH FREQUENCY CURRENTS IN AERIAL WIRES Topical Report, 1 Nov. - 30 Nov. 1974
Conrad L. Longmire 5 Aug. 1975 32 p
(Contract DNA001-75-C-0094)
(AD-A016671; MCR-R-164; DNA-3633T) Avail: NTIS CSCL 09/5

The report addresses, by approximate analytical means, the high-frequency part of the response to close-in surface-burst EMP of a radial wire in air, connected to a conduited down wire.
GRA

N76-19326# Duke Univ., Durham, N.C. Dept. of Electrical Engineering.
ADAPTIVE OPTIMUM ARRAY TRACKING DETECTORS Technical Summary Report, 1974 - 1975
Charles S. Liu Aug. 1975 242 p refs
(Contract N00014-75-C-0191)
(AD-A016590; TR-11) Avail: NTIS CSCL 09/4

The purpose of this study is to measure the performance degradation of array processors due to incorrect spatial a priori knowledge, and to further the theory of signal detectability for dynamic signals received by an array of sensors. Two classes of signal waveforms are considered in the first part of this report; one is the known waveform signal, the other is the Gaussian signal. For the known waveform case, an explicit functional form can be derived for the detectability index to characterize the performance loss. Performance results are shown for both the incorrect assumption about the signal location as well as the incorrect assumption about the directional noise location.
GRA

N76-19327# Riverside Research Inst., New York.
THE CALCULATION OF MILLIMETER AND SUBMILLIMETER WAVE ABSORPTION LINE PARAMETERS FOR THE MOLECULAR OXYGEN ISOTOPES (16)O2, (16)O(18)O, AND (18)O2
M. Greenbaum 15 Aug. 1975 120 p refs
(Contract DAAH01-74-C-0419; ARPA Order 2281)
(AD-A017397; RRI-T-1/306-3-14) Avail: NTIS CSCL 07/4

Calculations are described which yield absorption line parameters for the three isotopes of molecular oxygen: (16)O2, (16)O(18)O, and (18)O2, in the format of the AFCRL Atmospheric Absorption Line Parameters Compilation. The line parameters are: transition frequency, integrated line strength at 296K, line width, lower-state energy, and identifying quantum numbers. These parameters are required as input to the SLAM program (described elsewhere) which calculates the attenuation vs. altitude at any fixed frequency in the millimeter-to-submillimeter wave region.
GRA

N76-19328# Philco-Ford Corp., Willow Grove, Pa. Communication Systems Div.
DIGITAL PROCESSING TRANSCEIVER: PROGRAM SUMMARY AND TEST RESULTS Final Technical Report, Apr. 1972 - Jan. 1975
Kenneth Abend, James S. Bowker, Constantine Gumacos, Max A. Kraft, Anthony Mattei, and Leo W. Procopio Griffiss AFB, N. Y. RADC Jul. 1975 237 p
(Contract F30602-72-C-0328; AF Proj. 4519)
(AD-A017487; RADC-TR-75-193) Avail: NTIS CSCL 17/2

Two experimental models of a digital processing transceiver have been designed, constructed and tested. The transceiver modulation capability is multi-mode (AM, SSB, FM, PM, FSK) and the unit is capable of operation in the HF and VHF frequency bands. The concept of digital equivalent processing in terms of satisfying typical radio specification requirements in real time has been proven by extensive testing. GRA

N76-19329# Tactical Air Command, Langley AFB, Va. Directorate Force Development and Analysis.
AN INTRODUCTION TO SPREAD SPECTRUM MODULATION
Russell E. Lueg and Richard A. Freet 24 Oct. 1975 27 p refs
(AD-A017499; XPS-TN-75-9) Avail: NTIS CSCL 17/2

This technical note provides a survey of spread spectrum techniques and applications. Included are discussions of the various spread spectrum modulating techniques, system processing gains, and resistivity to jamming and interference. Author (GRA)

N76-19330# Stein Associates, Inc., Waltham, Mass.
MODULATION STUDY Final Technical Report
Dennis J. Gooding 28 Oct. 1975 45 p refs
(Contract N62269-76-M-2163)
(AD-A017465; Rept-6070-01) Avail: NTIS CSCL 17/2

The report details the results of a study to evaluate and compare three candidate spread-spectrum waveforms for a combined communication and ranging system. These waveforms, specified for their low out-of-band interference characteristics, were minimum shift keying (MSK), staggered quadraphase PSK (SQPSK), and shapped biphase keying (SBK). The study considers out-of-band interference characteristics, anti-jam performance, time of arrival accuracy and complexity of implementation. GRA

N76-19331# Naval Electronics Lab. Center, San Diego, Calif.
SEA TEST OF STARLING INTERFEROMETER DF RECEIVER Final Report, Oct. 1973 - May 1974
B. R. Hunt and M. B. Bryant 29 Aug. 1975 66 p
(AD-A017133; NELC-TR-1962) Avail: NTIS CSCL 17/3

Tests and analyses with the Starling multichannel interferometer direction of arrival (DOA) system demonstrated that such a multichannel phase-comparison DOA system will provide azimuth and elevation accuracy in a multipath environment; does not require physical stabilization of the antenna array; that multitarget processing is within the capabilities of the system. GRA

N76-19332# Naval Electronics Lab. Center, San Diego, Calif.
HF RECEIVING SYSTEM DESIGN STUDY FOR SMALL SHIPS: RECEIVE SYSTEM DESIGN FACTOR FOR SMALL-SHIP TYPES ARE EXAMINED Technical Document, Jul. 1974 - Jun. 1975
J. L. Lievens and A. R. Evans 15 Aug. 1975 24 p refs
(XF21222013; NELC Proj. B187)
(AD-A017077; NELC-TD-446) Avail: NTIS CSCL 17/2

Receive systems design factors are discussed and several design options are presented for receive systems as part of the Small Ship HF RF Distribution System Program. This study shows that the one chosen will have to be based on the number of receive circuits required. An appendix to this report describes a

method using diodes for reducing interference from operation of the AN/SRA-49 receive multicoupler overload circuits.
Author (GRA)

N76-19333# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE LINCOLN DIGITAL VOICE TERMINAL SYSTEM
Peter E. Blankenship, Edward M. Hofstetter, Albert H. Huntoon, Marilyn L. Malpass, Stephanie Seneff, and V. J. Sferrino 25 Aug. 1975 72 p refs
(Contract F19628-76-C-0002)
(AD-A017569; TN-1975-53) Avail: NTIS CSCL 17/2

An ultra-high performance programmable speech processor, consisting in the main of a custom designed 55-nsec microcomputer, has been designed and constructed. To date, five real-time speech compression programs have been implemented and evaluated. GRA

N76-19334# Defense Communications Engineering Center, Reston, Va.
SATELLITE PACKET BROADCASTING TO VERY SMALL EARTH STATIONS
Norman Abramson Sep. 1975 24 p refs
(AD-A017074; TN-38-75) Avail: NTIS CSCL 17/2

This report analyzes the throughput of an ALOHA channel when compared to a conventional satellite point-to-point channel of the same average power. Results show that in the limit of large numbers of small earth stations, the ALOHA throughput reaches 100% of the point-to-point capacity. Author (GRA)

N76-19335# Marine Corps Development and Education Command, Quantico, Va. Development Center.
LANDING FORCE INTEGRATED COMMUNICATIONS SYSTEM ARCHITECTURE, 1975 - 1990
Barry N. Bittner 1 Oct. 1975 204 p
(CMC Proj. 28010M)
(AD-A017287; CC-09-1-02-6) Avail: NTIS CSCL 17/2

The document sets forth the USMC Landing Force Integrated Communications System (LFICS) Architecture for the years 1975 through 1990. The architecture is a system plan which will be used as a guide in the future development of Marine Corps tactical communication equipment over the next fifteen years. This document will be updated annually in March. GRA

N76-19336# Stanford Univ., Calif. Electronics Labs.
SCATTERING OF MILLIMETER WAVES IN LINE-OF-SIGHT PROPAGATION Final Report, 1 Aug. 1973 - 31 Mar. 1975
Alan J. Waterman, Jr. L. G. Hanscom Field, Mass. AFCRL Aug. 1975 23 p
(Contract F19628-74-C-0013; AF Proj. 8682)
(AD-A016448; SU-SEL-75-041; AFCRL-TR-75-0465) Avail: NTIS CSCL 20/14

Line-of-sight propagation measurements at 34.89 GHz and 11.63 GHz on a 28 km path are analyzed with particular emphasis on (a) transmissable bandwith and (b) the effects of rain. Bandwidth studies are approached by measuring the frequency covariance of the 3:1 frequency ratio employed, and then using the theory of weak scattering to infer the covariance of signal fluctuations at lesser frequency separations. The conclusions reached from this approach indicate negligible bandwith limitations for bandwidths of a few per cent (300-400 MHz, at 35 GHz), as a consequence of single scattering processes; i.e., the inferred frequency covariance between extremes in the band should exceed 0.95. The effects of rain, while showing up markedly in attenuation at the higher frequency, do not have other consistently deleterious consequences. Angle-of-arrival jitter is relatively unaffected. Frequency covariance is more erratic during squally weather but tends to rise during times of heavy rain.
GRA

N76-19337# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
AN ELECTRONIC TARGET GENERATOR TO TEST TELEVISION CONTRAST AUTOMATIC TRACKERS
Michael C. Pitruzzello, Mark D. Dixon, and Leonard M. Moore 14 Aug. 1975 20 p
(DA Proj. 1M3-62303-A-214)
(AD-A017080; RG-76-8) Avail: NTIS CSCL 17/8

The US Army Missile Development Center's efforts in the area of precision pointing and tracking has shown the importance of automatic trackers for precision pointing of armament. One of the most widely used types of automatic trackers is the television contrast automatic tracker. However, many different approaches exist to this one type of tracking, each with distinct advantages and disadvantages. This fact along with the difficulty of testing one tracker against another in the field due to continually varying parameters has shown a need for laboratory equipment to uniformly test television contrast trackers. This report describes the development of an electronic target generator which can be used to obtain uniform test data on television contrast automatic trackers. Author (GRA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-19338* National Aeronautics and Space Administration. Pasadena Office, Calif.
MINIATURE MUSCLE DISPLACEMENT TRANSDUCER Patent
Cyril Feldstein (JPL), Jules V. Osher (JPL), Gilbert W. Lewis (JPL), Robert H. Silver (JPL), and Edward N. Duran, inventors (to NASA) (JPL) Issued 10 Feb. 1976 5 p Filed 27 Dec. 1974 Supersedes N75-17102 (13 - 08, p 0923) Sponsored by NASA
(NASA-Case-NPO-13519-1; US-Patent-3,937,212; US-Patent-Appl-SN-536761; US-Patent-Class-128-2S; US-Patent-Class-33-155R; US-Patent-Class-33-174D; US-Patent-Class-73-88.5SD) Avail: US Patent Office CSCL 09A

The miniature transducer for sensing muscle displacement substantially consists of a curved beam of high elastic compliance connected at its ends to two prongs. The prongs have sharpened tips which are insertable into the muscle. A sensitive strain gauge is bonded to the beam preferably at the point of greatest curvature. The strain gauge output is directly related to changes in the beam curvature. As the muscle expands, the spacing between the prongs increases which decreases the beam curvature. On the other hand, when the muscle contracts the prongs' spacing decreases, thereby increasing the beam curvature.
Official Gazette of the U.S. Patent Office

N76-19339* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRICAL CONDUCTIVITY CELL AND METHOD FOR FABRICATING THE SAME Patent
William P. Gilbreath (Foothill Coll.), Michael J. Adamson (Foothill Coll.), and Alexander G. Fassbender, inventors (to NASA) (Foothill Coll.) Issued 10 Feb. 1976 5 p Filed 16 Jul. 1974 Supersedes N74-29772 (12 - 19, p 2282) Sponsored by NASA
(NASA-Case-ARC-10810-1; US-Patent-3,938,035; US-Patent-Appl-SN-489009; US-Patent-Class-324-30B; US-Patent-Class-204-195R; US-Patent-Class-215-247) Avail: US Patent Office CSCL 09C

A flask having a threaded neck and a cap adapted for threaded engagement on the neck are used. A laminated disc between the cap and the neck forms a gas tight seal and the cap has a central opening that exposes a medial region of the disc. Piercing the disc through the opening are two electrodes, the inner ends of which contact the sample within the flask and the outer ends of which can be connected to test equipment. Cylindric glass tubes are fitted over the external portion of the electrodes to provide physical support and silicone rubber or a similar material serves to retain the glass cylinders in place and form a gas tight seal between the cylinders and the electrodes. Shrinkable tubing is shrunk over the glass tubes to afford further mechanical support and sealing. A final relatively large diameter shrinkable tube is shrunk over both electrodes and their associated glass

cylinders. The support and sealing means for the electrodes is confined to a limited portion of the medial region of the disc so that the remainder of such region can be punctured by a hollow needle to introduce a test sample within the flask.
Official Gazette of the U.S. Patent Office

N76-19340 Stevens Inst. of Tech., Hoboken, N.J.
INVESTIGATION OF BOUNDARY EFFECTS ON GUNN OSCILLATOR OPERATION Ph.D. Thesis
Ignace Gregoire Atohoun 1975 117 p
Avail: Univ. Microfilms Order No. 76-5020

A three dimensional mathematical model of an X-band cylindrical Gunn-effect device operating with and without an electromagnetic cavity has been developed. The partial differential equations representing the model are the Poisson and current continuity equations within the device, and, the wave equation for the scalar potential outside the device. These equations were solved with the appropriate boundary conditions (in cylindrical coordinate) using the finite difference technique. This model was used to investigate boundary effects on Gunn oscillator operation. Dissert. Abstr.

N76-19341 Carnegie-Mellon Univ., Pittsburgh, Pa.
BLOCKING GATE ADDED LOGIC FOR ENHANCING TESTABILITY IN LSI CIRCUITS Ph.D. Thesis
Eliezer Sternheim 1975 167 p
Avail: Univ. Microfilms Order No. 76-4730

A blocking gate added logic technique for enhancing the test generation and selection for large scale integrated circuits was developed. The blocking gates and one input pin are added to the original circuit in such a way that if the extra input pin is in the 0 state, the circuit operates in normal mode and the added logic has no effect on its operation. When the extra input pin is in the 1 state, the circuit is in test mode and the blocking gates which were inserted in a few key points in the circuit block the propagation of some logical values while enabling the propagation of others. When the blocking gates are used to improve detectability, the circuit is modelled as a collection of input neighborhoods (IND) where each IND consists of a memory element or primary output, together with the combinational network which feeds it. Several algorithms for blocking gate insertion are tried and compared by using a testability measure. Dissert. Abstr.

N76-19342 California Inst. of Tech., Pasadena.
MECHANISMS OF PHOTOCURRENT GENERATION AT METAL AND SEMICONDUCTOR ELECTRODES Ph.D. Thesis
Harry Osborn Finklea 1976 134 p
Avail: Univ. Microfilms Order No. 76-6527

An attempt to measure the electrochemical properties of an excited molecule is made. Polyaromatics and Ru(bipy) 3(2+) are photo excited in nonaqueous electrolytes via a monochromatic beam passing through a thin metal film electrode. It is concluded that observation of charge transfer from an excited molecule is not possible because of rapid quenching by energy transfer to the electrode. All observed photocurrents in the presence of a light absorbing solute are explained by heating of the solution near the interface or the photochemical generation of electroactive products. Anodic and cathodic photocurrents are observed in the absence of a dye. The mechanism of the latter process entails the formation of excited holes and electrons within the metal with their subsequent reaction at the interface. Photoelectron ejection into the solution is also proven by the effects of an electron scavenger. Dissert. Abstr.

N76-19343 Stanford Univ., Calif.
MULTIPLE FAULT ANALYSIS IN COMBINATIONAL LOGIC CIRCUITS Ph.D. Thesis
Francisco Jose de Oliveira Dias 1975 195 p
Avail: Univ. Microfilms Order No. 76-5777

The effects of multiple-faults on the behavior of combinational logic circuits are examined. A fault is defined as a mathematical representation for a failure in a circuit. For simplicity it is commonly assumed that at most one line in the circuit will be faulty at any time (single-fault model). Unfortunately, the detection of all single-faults does not guarantee the detection of all multiple-faults. Thus the single-fault assumption may give poor results for technologies like LSI (large scale integration). Three aspects of multiple-faults are considered. Mathematical properties of faults in a combinational circuit; a procedure for the generation of tests for these faults; highly structured circuits (iterative logic arrays). The so called stuck-at fault model is generalized into a more powerful fault model. Dissert. Abstr.

N76-19344*# Vought Corp., Dallas, Tex.
ELECTRONIC DELAY IGNITION MODULE FOR SINGLE BRIDGEWIRE APOLLO STANDARD INITIATOR
R. D. Ward [1975] 284 p refs
(Contract NAS1-12500)
(NASA-CR-144898) Avail: NTIS HC $9.25 CSCL 09C

An engineering model and a qualification model of the EDIM were constructed and tested to Scout flight qualification criteria. The qualification model incorporated design improvements resulting from the engineering model tests. Compatibility with single bridgewire Apollo standard initiator (SBASI) was proven by test firing forty-five (45) SBASI's with worst case voltage and temperature conditions. The EDIM was successfully qualified for Scout flight application with no failures during testing of the qualification unit. Included is a method of implementing the EDIM into Scout vehicle hardware and the ground support equipment necessary to check out the system. Author

N76-19345# Sandia Labs., Albuquerque, N.Mex.
EFFECT OF SYSTEM PARAMETERS ON SUBSTRATE BIAS DURING dc AND RF SPUTTER DEPOSITION
G. J. Kominiak and R. D. Bland Jul. 1975 17 p refs
(Contract AT(29-1)-789)
(SAND-75-0159) Avail: NTIS HC $4.00

When an electrically isolated substrate holder is immersed in a gas discharge, as in sputter deposition, the holder and substrates are exposed to bombardment by energetic secondary electrons which may result in large substrate bias voltage. The variation of bias is measured at an electrically floating substrate as a function of gas pressure and target to substrate separation for both dc and RF sputtering discharges. In the case of dc sputtering the voltages may attain negative potentials of up to 1 kV. Operating under these conditions will cause severe heating of the substrates and the growing deposits the RF sputtering discharges induce relatively small negative (less than -100 V) and positive voltages at the substrate. These small positive biases are shown to affect the properties of RF sputtered metal films. In the case of RF sputter deposited chromium, electrically floating the substrates resulted in deposits which were only approximately 70 percent dense. Author (NSA)

N76-19346# Oak Ridge National Lab., Tenn.
CALCULATION OF MAGNETIC FIELDS FROM TIME-VARYING CURRENTS IN THE PRESENCE OF CONDUCTORS
C. V. Dodd and W. E. Deed Jul. 1975 40 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4958) Avail: NTIS HC $5.00

Equations were derived for the magnetic field for the case of a cylindrically symmetric coil of rectangular cross section being driven by a sinusoidal current above conducting plates. Computer programs were written to numerically evaluate these equations. The most general program calculates the field for a coil above multiple (up to 9) plates, each having any resistivity and thickness. The field is calculated anywhere in or behind the conductors, and for five different values of coil-to-conductor spacing. The total eddy-current power dissipated in the conductors is also calculated, as well as the magnetic field at the center of the coil. Equations were also derived for the Fourier analysis of pulse, the power density, and the eddy-current force density; but no programs were written for these. Author (NSA)

N76-19347# Los Alamos Scientific Lab., N.Mex.
DESIGN OF A FORCE-FREE INDUCTIVE STORAGE COIL
O. K. Mawardi Apr. 1975 11 p refs
(Contract W-7405-eng-36)
(LA-5953-MS) Avail: NTIS HC $4.00

Force free coils are considered for various applications as energy storage devices. A novel energy storage system consisting of both toroidal and poloidal coils is developed. In this system, the Lorentz forces on the two coils are in opposition and can

be made to cancel by having the proper ratio of ampereturns in the two coils. A general discussion of force free coil design is given, and the toroidal-poloidal coil system is described. The materials costs of magnets constructed with this and other geometries are compared. The conclusions are that conductor cost of this system lies between those of solenoids and toroids, and that the costs of structural material may be considerably less than either of these simpler coils. Author (NSA)

N76-19348# Technische Universitaet, Munich (West Germany). Inst. fuer Technische Elektronik.
PYROELECTRIC FIELD EFFECT TRANSISTORS Final Report [PYROELEKTRISCHE FELDEFFEKTTRANSISTOREN]
Friedrich Schalkhausser Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-20) Avail: NTIS HC $4.50; ZLDI, Munich DM 14.30

The effect of the electric field of a pyroelectricum, generated by temperature-dependent spontaneous polarization, on the charge carrier concentration of a semiconducting film vacuum deposited on a pyroelectric LiTaO3 crystal was investigated with a view to developing pyroelectric field effect transistors. The volt-ampere characteristics were measured as a function of temperature. It is shown that the temperature-dependent field is capable of producing charge carrier enrichment as well as depletion in the semiconductor. The signal to noise ratio was also investigated. ESA

N76-19349# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
STUDY AND DEVELOPMENT OF HIGHLY RELIABLE RANDOM ACCESS SEMICONDUCTOR MEMORY Final Report, Jan. - Dec. 1974
P. W. Rivers-Latham, J. D. Wilcock, N. A. Batt, and C. H. Paterson Dec. 1974 219 p refs
(Contract ESTEC-2068/73-HP)
(CD.6500605/K; ESA-CR(P)-746) Avail: NTIS HC $7.75

Design principles for highly reliable random access semiconductor memories are discussed. The memories include volatile and non-volatile data storage partitions and operate in conjunction with an established on-board-computer. The design principles allow the derivation of the optimum organization in terms of the desired memory capacity and the component reliabilities. The necessity for error detection and correction or reconfiguration can also be determined. An 8K16 memory was designed in detail to demonstrate the design principles. Suitable components, device packages, mechanical assembly, reliability, radiation resistance, error detection and correction, reconfiguration and software were considered. Author (ESA)

N76-19350# Monsanto Research Corp., Dayton, Ohio.
PLANAR HIGH ENERGY PERMANENT MAGNETS Final Report, 1 Mar. 1973 - 31 Mar. 1975
M. C. Willson and R. J. Janowiecki Jul. 1975 49 p refs
(Contract DAAB07-73-C-0112; DA Proj. 1T7-62705-A-348)
(AD-A016162; MRC-DA-500; ECOM-73-0112-F) Avail: NTIS CSCL 09/1

Samarium-cobalt permanent magnets were fabricated by arc plasma spraying in order to evaluate this technique as an economical method for fabricating cobalt-rare earth magnets for advanced traveling wave tubes and crossfield amplifiers. Bar magnets were produced having a coercive force of 6100 oersteds and an energy product of 10.8 million gauss-oersted. The magnetic properties in bar magnets were significantly better in the direction parallel to the spray direction. $SmCo_5$ bar magnets were directly bonded to magnesia-excess spinel substrates and showed no evidence of cracking or warping in the magnet-substrate assembly even after heat treatment. Two 52-bar magnet assemblies were constructed, each consisting of two 26-bar arrays, 1 inch x 8 inch. The bar magnets were magnetized so as to achieve peak axial field strengths of 450 to 500 gauss with a period of 0.6 inch in each assembly. GRA

N76-19351# Westinghouse Research Labs., Pittsburgh, Pa.
SUPERCONDUCTING WINDINGS Final Report
M. S. Walker and J. H. Murphy Sep. 1975 84 p refs
(Contract N00014-73-C-0461)
(AD-A016050; Rept-75-9C31-CRYEL-Rz) Avail: NTIS CSCL 09/1

The report summarizes the results of an approximately 20 man month experimental and theoretical effort which has culminated with the construction of a mathematical model for the calculation or estimation of losses in multifilament superconductors. The model treats the practical case of ramped or transient magnetic fields transverse to conductor elements of circular or rectangular cross section and carrying fixed or changing transport currents which may or may not be related to field changes. The model, which has not been completely verified experimentally and in many instances points the way for further work, is presented complete with background, justification, qualifications, and example calculations. Experimental accomplishments, mainly calorimetric loss measurements, and theoretical accomplishments are summarized in part through a presentation of abstracts with references to relevant publications or to as yet unpublished results some of which are presented in the appendices. GRA

N76-19352# American Electronic Labs., Inc., Lansdale, Pa.
LOW LEVEL MODULATOR AND ISOLATOR-LIMITER-DETECTOR DEVELOPMENT Final Report, 28 Jan. - 30 Sep. 1975
Donald L. Talhelm 1 Oct. 1975 30 p
(Contract N00014-74-C-0393; AEL Proj. 10077)
(AD-A016292) Avail: NTIS CSCL 09/5

The report summarizes the development of an I-J Band low-level modulator and isolator-limiter-detector for use in the UHF range. Test data on insertion loss, attenuation, isolation, VSWR and response times are included for the modulator. For the isolator-limiter-detector data on tangential signal sensitivity (TSS) and VSWR are presented. GRA

N76-19353# Illinois Univ., Urbana. Coordinated Science Lab.
REFLECTIVITY OF INTERDIGITALLY AND FACT-TO-FACE POLED SURFACE ACOUSTIC WAVES TRANSDUCERS M.S. Thesis
James Thomas Pye Jul. 1975 47 p refs
(Contract DAAB07-72-C-0259)
(AD-A015809; R-684; UILU-ENG-75-2219) Avail: NTIS CSCL 09/1

Methods of measuring and modulating the reflectivity interdigital transducers are investigated through a dc field applied to the transducer, varying the electrical termination of the transducer, and removing the aluminum pattern on the substrate. GRA

N76-19354# Harry Diamond Labs., Adelphi, Md.
DAMAGE ANALYSIS MODIFIED TRAC COMPUTER PROGRAM (DAMTRAC)
George H. Baker, Alan D. McNutt, David M. Rubenstein, and G. Bradford Shea May 1975 95 p refs
(DA Proj. 1W1-62118-AD-51; HDL Proj. X755E2)
(AD-A016776; HDL-TM-75-6) Avail: NTIS CSCL 09/5

A computer program tailored for EMP damage analysis of solid-state circuitry has been developed by modifying the existing transient radiation analysis by computer (TRAC) network analysis program. Modification of the TRAC diode and transistor models to include breakdown parameters and the addition of a semiconductor device parameter library have greatly simplified the analyst's task. An added feature is a subroutine that automatically calculates the amplitude and duration of transient power dissipated in circuit components. GRA

N76-19355# Radio Corp. of America, Camden, N.J.
RADIATION-HARDENED CMOS/SOS STANDARD CELL CIRCUITS Quarterly Reports, 3 May - 3 Aug. 1975
R. L. Pryor and A. Feller Sep. 1975 26 p
(Contract N00014-75-C-0709; DNA Proj. NWED-QAXTD033)
(AD-A017021; ATL-CR-75-11; QR-2) Avail: NTIS CSCL 09/5

The design, layout, simulation and characterization of all of the cells in the CMOS/SOS radiation hardened standard cell family were completed, with but one exception. Data sheets were generated providing design information for each of the cells. Among the information included in the data sheets are stage delay and transition times for preradiation and for the

worst-case end of total dose 10 to the 6th power rads; input and output capacitances; logic and circuit configurations; truth table; and other design data. Two LSI arrays are being designed to provide experimental evaluation, characterization, and validation of the radiation-hardened CMOS/SOS circuits. One of these arrays, a test chip with more than 30 tests on it, permits measurements to be taken directly on each of the cells. This provides for determining the effect of total dose and dose rate on the leakage, performance, and reliability of each of the cells. An analysis was completed to determine specifically what changes must be made in the present adder in order to generate the radiation-hardened version. Essentially, this involved the replacement of the radiation-hardened cells for the presently used cells, the elimination of the transmission gate through the arrays, and the elimination of all gates with four or more inputs. GRA

N76-19356# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE APPLICATION OF ITERATED CONSENSUS TO MULTIPLE-VALUED LOGIC DESIGN M.S. Thesis

John A. Larkin Jun. 1975 96 p refs

(AD-A017456; GE/EE/75-6) Avail: NTIS CSCL 09/5

Present day switching theory deals with binary circuits. Inherently, however, some signals are not two-valued in nature. With recent advances in integrated circuit technology, multiple-output devices have become more feasible. Thus, all that is needed to make practical use of these devices as they are made available is a generalized mathematical model which can be manipulated and implemented relatively easily. In this report, a multi-valued algebra is introduced as a mathematical model for the study of switching circuits having two or more logic values; and some of the techniques for manipulating switching functions are presented. In particular, a map method related to the Karnaugh map is presented. As in the two-valued case, the prime implicants of a function can be found directly from its map. Unfortunately, this map method is practical only for functions of three or fewer variables. An operation which is applicable to functions of any number of variables is the generalized consensus operation. In the literature, Allen and Givone have developed an iterated consensus procedure for multi-valued, single-output functions. This thesis presents the extension to the multiple-output function case. GRA

N76-19357# Army Electronics Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.

AVALANCHE AND DEPLETION REGION WIDTHS FOR UNIFORMLY DOPED GALLIUM ARSENIDE IMPACT AVALANCHE TRANSIT TIME DIODES

Kenneth L. Klohn and John F. Armata, Jr. Nov. 1975 44 p refs

(DA Proj. 1S7-62705-AH-94)

(AD-A017475; ECOM-4368) Avail: NTIS CSCL 09/1

High dc to RF conversion efficiency is one of the primary objectives in designing impact avalanche transit time (IMPATT) devices. To aid in the design for best efficiency for any given frequency, it is very desirable to know the size of the avalanche region and depletion layer as a function of the doping concentration in the material. This report summarizes the dc analysis used to determine values of breakdown voltage, depletion layer width, maximum electric field, avalanche width to depletion width ratio, dc to RF conversion efficiency and the range of possible transit time frequencies, all as a function of doping concentration between 1 x 10 to the 15th and 1 x 10 to the 17th atoms per cu cm. A calculator program is presented to perform the above calculations. Comparisons were made among four different sets of constants found in the literature for the ionization rate equation at room temperature and three sets for an operating temperature of 200 C. Calculations were made for a uniformly doped gallium arsenide IMPATT device which is the simplest structure to fabricate. GRA

N76-19358# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH VOLTAGE PULSE CAPACITORS

G. S. Kuchinskii 29 Apr. 1975 199 p refs Transl. into ENGLISH of the book "Vysokovoltnye Impulsive Kondensatory" Leningrad, Energiya Leningradskoye Otdeleniye, 1973 p 1-175

(AD-A017190; FTD-HC-23-2678-74) Avail: NTIS CSCL 09/1

High voltage pulse power capacitors are considered in this book. The characteristics of the basic insulation materials are presented. The physical processes arising in pulse capacitors under various operating conditions are considered. A technique is given for calculating the basic dimensions of capacitors, inductance, energy losses, thermal calculations, and evaluation of service life and reliability. The main contemporary types of domestic and foreign pulse capacitors are described. GRA

N76-19359# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Oct. - 31 Dec. 1974

W. Murray Bullis Nov. 1975 86 p refs

(ARPA Order 2397)

(AD-A017523; NBS-Special-Pub-400-17) Avail: NTIS CSCL 09/1

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period include (1) initiation of development of measurement technology for characterizing boron nitride diffusion sources and hydrogen chloride purging gas, (2) application of dc electrical methods with a sensitivity of about 0.1 micrometer to the measurement of critical dimensions such as the width of diffusion windows, (3) completion of an initial comparison of line-width measurements made with an image shearing eyepiece and a filar eyepiece, and (4) development of procedures for measuring electrically the thermal resistance of the output transistor of integrated Darlington pairs. GRA

N76-19360# Harry Diamond Labs., Adelphi, Md.

EMP TESTING OF BURIED CONDUITS, THE PULSED DIPOLE AND PULSED TRANSMISSION LINE

Huey A. Roberts, Edmund Seijo, and Forrest J. Agee Sep. 1975 16 p refs

(AD-A017299; HDL-TM-75-12) Avail: NTIS CSCL 09/1

Buried conduit systems form an integral part of the EMP shielding in large hardened missile systems such as SAFEGUARD to protect the communications, control, and power cabling from NEMP effects. To initially verify conduit system hardness and to ensure that it is maintained over the system life, nondestructive testing techniques are being developed to detect and locate their flaws that could adversely affect EMP hardness and to measure their impact on system hardness. Several testing techniques that have been developed are discussed, and experimental data are presented from measurements on buried conduits. GRA

N76-19361# Gudeman Corp., Chicago, Ill.

PRODUCTION ENGINEERING MEASURE FOR POLYSULFONE CAPACITORS FOR SHORT INTRUSION PROXIMITY FUZE Quarterly Report, 24 May - 24 Aug. 1975

Frank A. Lakowski 22 Sep. 1975 24 p

(Contract DAAB07-74-C-0337)

(AD-A017593; CSO-705-5; QR-5) Avail: NTIS CSCL 09/1

The object of the production engineering measure is to provide the production engineering necessary to improve the production process techniques of non-metal cased polysulfone capacitors used for short intrusion proximity fuzes. Capacitors are to be capable of meeting the requirements of SCS442 and MIL-C-55514 and are to attain a failure rate of 1% per 1000 hours at 90% confidence level at rated voltage at 85C. Official Qualification testing to Table X of MIL-C-55514A and SCS442 was completed during this period. Units satisfactorily met the requirements of Group II, III, IV and V of the Qualification test table. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-19362 Stanford Univ., Calif.
SOME LAMINAR FLOW PROBLEMS AT SMALL AND MODERATE REYNOLDS NUMBERS. NUMERICAL SOLUTIONS AND EXPERIMENTS Ph.D. Thesis
Gary Kenneth Youngren 1975 119 p
Avail: Univ. Microfilms Order No. 76-5833

Two classes of laminar flows are considered: Stokes or creeping flows, and steady, high Reynolds number separated flows. A method is detailed for solving the Stokes equations for general flow fields and arbitrary geometries that computes the drag, lift, and torque without solving a fully three dimensional problem. Such a method is applied to Stokes flow of an unbounded fluid past a single solid particle surface, thereby rigorously reducing the problem to the solution of a system of linear integral equations of the first kind for the stress force on the particle surface. Next, the method is extended to a situation where the shape of a deformable gas bubble is determined as part of the numerical solution. Finally, torques are computed for ellipsoids rotating about their principle axes and for a benzene molecule rotating normal to its symmetry axis with slip boundary conditions.
Dissert. Abstr.

N76-19363 Stanford Univ., Calif.
IMPROVEMENT OF SERIES WITH APPLICATIONS TO FLUID MECHANICS Ph.D. Thesis
Ramesh Kumar Agarwal 1975 176 p
Avail: Univ. Microfilms Order No. 76-5685

Methods of generating series solution for nonlinear ordinary and partial differential equations are suggested, in particular for the equations of two- and three-dimensional boundary layer theory. The first term of the series is a solution of the linear problem. The linearization is achieved by introducing artificially a small parameter epsilon either in the differential equation or one of the boundary conditions. After a number of terms of the series have been generated by hand calculation or computer, epsilon is replaced by unity. The series thus generated are not necessarily power series, but may contain exponentials, error functions and logarithmic functions. These solutions come under coordinate perturbation problems.
Dissert. Abstr.

N76-19364 Stanford Univ., Calif.
NUMERICAL SIMULATION OF TURBULENCE IN THE PRESENCE OF SHEAR Ph.D. Thesis
Shlomo Shaanan 1975 140 p
Avail: Univ. Microfilms Order No. 76-5800

Numerical computations of three-dimensional time-dependent turbulent flows are now feasible for three main reasons. The state of the art of numerical methods for solving the nonlinear Navier-Stokes equations of turbulent flow modeling for numerical simulations, and of fast computer hardware have all made three-dimensional simulation a reality. The numerical calculations of the large eddy structure of turbulent flows, by use of the averaged Navier-Stokes equations, where averages are taken over spatial regions small compared to the size of the computational grid. The subgrid components of motion are modeled by a local eddy-viscosity model. The numerical simulation of the model equations of turbulence proves to be a convenient way for extracting useful information on the physics of a variety of turbulent flows. The numerical results extend existing experimental data considerably.
Dissert. Abstr.

N76-19365 Massachusetts Univ., Amherst.
PART 1: HYDRODYNAMIC STABILITY OF TIME-DEPENDENT FLOWS. PART 2: THE EFFECT OF THE PRESSURE-DEPENDENCE OF VISCOSITY ON THE CAPILLARY FLOW OF NEWTONIAN FLUIDS Ph.D. Thesis
Peter James Riley 1975 481 p
Avail: Univ. Microfilms Order No. 76-5387

A comprehensive survey and critique is made of the literature on the stability of time dependent flows. The theory is illustrated with particular references to the Taylor and Benard problems, but encompasses most of the available literature with the exception of magnetohydrodynamics. Linear and energy stability of time periodic flows may be considered to be closely analogous to that of steady flows. Results of a number of theoretical and experimental studies into the pressure dependence of viscosity and its effects upon fluid motion are also reported.
Dissert. Abstr.

N76-19366 Stanford Univ., Calif.
DYNAMIC BEHAVIOR OF PIPES CONVEYING FLUID NEAR CRITICAL VELOCITIES Ph.D. Thesis
Jean Rousselet 1975 117 p
Avail: Univ. Microfilms Order No. 76-5792

One of the instabilities which can occur in pipes conveying fluid is flutter (oscillatory instability). This instability sets in when the fluid flow reaches a critical velocity. The subject of the present work is to investigate the effect of finite amplitudes of motion on such critical velocities. One consequence of these finite amplitudes is the coupling, through nonlinear terms, of the equation governing the motion of the fluid with the transverse equation of motion of the pipe. Hence, in contrast to earlier studies, the flow velocity will not be prescribed but left to follow the laws of motion. The results permit an increase of confidence in the prediction of the linear analysis since they show that the contribution of the nonlinearities affect but little the stability of pipes conveying fluid.
Dissert. Abstr.

N76-19367*# Florida Univ., Gainesville.
A METHOD FOR CALCULATING THE INDUCED PRESSURE DISTRIBUTION ASSOCIATED WITH A JET IN A CROSSFLOW M.S. Thesis
William E. Dietz, Jr. 1975 82 p refs
(Grant NGR-10-005-127)
(NASA-CR-146434) Avail: NTIS HC $5.00 CSCL 20D

A model is presented which can be used to study the loss of lift during hovering and horizontal flight of the VTOL aircraft. The model numerically predicts the pressure distribution induced by a round, turbulent, unheated, subsonic jet exhausting normally through a flat plate into a subsonic crossflow. The complete model assumes that the predominant features of the flow are jet entrainment and a pair of contrarotating vortices which form downstream of the jet. Experimentally determined vortex properties and a reasonable assumption concerning jet entrainment were used. Potential flow considerations were used except in the wake region, where a simple method for approximating the pressure distribution was suggested. The calculated pressure distribution, lift, and pitching moments on the flat plate are presented for a jet to crossflow velocity ratio of 8 and were compared with experimental results. A computer program is given which was used to calculate the pressure distribution across the flat plate.
Author

N76-19368*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOT WIRE ANEMOMETRY IN TRANSONIC FLOW
C. C. Horstman and W. C. Rose Dec. 1975 28 p refs
(NASA-TM-X-62495; A-6309) Avail: NTIS HC $4.00 CSCL 20D

The use of hot-wire anemometry for obtaining fluctuating data in transonic flows has been evaluated. From hot-wire heat loss correlations based on previous transonic data, the sensitivity coefficients for velocity, density, and total temperature fluctuations have been calculated for a wide range of test conditions and sensor parameters. For sensor Reynolds numbers greater than 20 and high sensor overheat ratios, the velocity sensitivity remains independent of Mach number and equal to the density sensitivity. These conclusions were verified by comparisons of predicted sensitivities with those from recent direct calibrations in transonic flows. Based on these results, techniques are presented to obtain meaningful measurements of fluctuating velocity, density, and Reynolds shear stress using hot-wire and hot-film anemometers. Examples of these measurements are presented for two transonic boundary layers.
Author

N76-19369*# Applied Theory, Inc., Los Angeles, Calif.
COMPUTATION OF STEADY AXISYMMETRIC FLOW USING A ONE-DIMENSIONAL TIME-DEPENDENT METHOD
Leonard Walitt Aug. 1974 61 p refs
(Contract NAS2-4998)
(NASA-CR-137818; ATR-74-16-1) Avail: NTIS HC $4.50 CSCL 20D

An iterative numerical method for computing steady, three dimensional, viscous, compressible flow fields, about aerodynamic

bodies was studied. In order to develop the iterative method economically, the primary emphasis was directed towards supersonic, axisymmetric flow. However, the technique readily extends to three spatial dimensions. The viscous flow field about a cone-cylinder-flare body was calculated and compared to existing experimental data. Numerical predictions of the cone boundary layer and the flow field shock wave structure agreed with corresponding measurements. A separation was calculated at the cylinder-flare junction in six iterations; however, the size of the vortex did not correspond to the measured size. It was estimated that fifty iterations would be required to properly define the vortex. It was concluded that the iteration technique is of limited value for plane two dimensional and axisymmetrix flows, but of great value for three-dimensional flows. Author

N76-19370# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
MASS TRANSFER THROUGH A POROUS TUBE. PART 2: APPARATUS, EXPERIMENTAL PROCEDURE AND RESULTS
B. A. Rotteveel Oct. 1975 109 p refs
(Rept-63-Pt-2) Avail: NTIS HC $5.50

The detailed design of the apparatus constructed to study the flow of fluid through a porous pipe with lateral mass extraction and addition was presented, as well as preliminary test results. The following areas were included in the design of the equipment: the air supply, flow regulation and measurement, the working section, hot-wire anemometry and traversing mechanism, and experimental procedure. The experimental results include pitot traverse readings, hot-wire traverse readings, and calculated volume flow rates, in the form of tables and graphs. Comparisons were made with results obtained by other researchers. Y.J.A.

N76-19371*# Kanner (Leo) Associates, Redwood City, Calif.
SOLUTION OF THE BOUNDARY VALUE PROBLEM OF DETERMINING THE AXISYMMETRIC EQUILIBRIUM SURFACE OF A LIQUID UNDER WEAK GRAVITY CONDITIONS
S. B. Keleberdenko Washington NASA Mar. 1976 32 p refs Transl. into ENGLISH from the book "Dinamika i Ustoychivost Mnogomernykh Sistem" Kiev, Inst. of Math., Acad. of Sci. Ukr. SSR Press, 1974 p 107-127
(NASA-TT-F-16898) Avail: NTIS HC $4.00 CSCL 20D

An algorithm for the construction of an axisymmetric equilibrium surface of a liquid under weak gravity is discussed which makes allowance for surface tension. The existence of a solution is discussed and determination of the solution of the boundary value problem is reduced to solving transcendental equations. The actual solution is found in the form of power series. Numerical calculations for vessels with different geometric forms are presented. Author

N76-19372*# Transemantics, Inc., Washington, D.C.
UNIQUENESS THEOREMS FOR SOLVING AN INVERSE HEAT CONDUCTION PROBLEM
V. V. Frolov NASA Feb. 1976 13 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. (USSR), v. 29, no. 1, Jul. 1975 p 145-150
(Contract NASw-2792)
(NASA-TT-F-16840) Avail: NTIS HC $3.50 CSCL 20M

The single-valued conditions of solution of the inverse heat conduction problem are formulated in terms of properties of an observed unsteady temperature field and possible sufficient variations of the initial distribution. A close relationship exists between single-valued conditions and group properties of the heat conduction equation; in particular, there is agreement between a class of temperature fields giving a non-single-valued solution of the inverse problem and that of invariant solutions. Author

N76-19373*# General Electric Co., Philadelphia, Pa. Space Sciences Lab
FLUID FLOW ELECTROPHORESIS IN SPACE Final Report
Richard N. Griffin Dec. 1975 41 p refs
(Contract NAS8-29878)
(NASA-CR-144218) Avail: NTIS HC $4.00 CSCL 20D

Four areas relating to free-flow electrophoresis in space were investigated. The first was the degree of improvement over earthbound operations that might be expected. The second area of investigation covered the problems in developing a flowing buffer electrophoresis apparatus. The third area of investigation was the problem of testing on the ground equipment designed for use in space. The fourth area of investigation was the improvement to be expected in space for purification of biologicals. The results of some ground-based experiments are described. Other studies included cooling requirements in space, fluid sealing techniques, and measurement of voltage drop across membranes. Author

N76-19374*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL STUDY OF TRANSIENT LIQUID MOTION IN ORBITING SPACECRAFT
Robert L. Berry and James R. Tegart Feb. 1976 172 p refs
(Contract NAS8-30690)
(NASA-CR-144213; MCR-76-11) Avail: NTIS HC $6.75 CSCL 20D

A test program was conducted involving forty-five drops of liquid propellant in instrumented tanks. Biaxial, low-g accelerations were applied to the model propellant tanks during free-fall testing, and forces exerted during liquid reorientation were measured and recorded. High speed photographic records of the liquid reorientation were also made. The test data was used to verify a mechanical analog which portrays the liquid as a point mass moving on an ellipsoidal constraint surface. The mechanical analog was coded into two FORTRAN 4 digital computer programs. Results showed excellent correlation between test data and analytical predictions of reorientation forces and liquid center of mass motion, verifying the basic analytical approach. Author

N76-19375*# Scientific Translation Service, Santa Barbara, Calif.
TURBULENCE EFFECTS ON SETTLING AND TRANSPORT OF SOLID PARTICLES IN SUSPENSION
Valerio Milano Washington NASA Mar. 1976 28 p refs Transl. into ENGLISH from Inst. of Hydraulics, Pisa Univ. (Italy), Publ. No. 1515, Ser. 31 p 447-475
(Contract NASw-2791)
(NASA-TT-F-16907) Avail: NTIS HC $4.00 CSCL 20D

The settling of suspended solid particles is discussed in terms of concentration at a point and the probability that a particle traverses the point at a given instant by use of equations of motion. Models for a particle in turbulent water are developed. Author

N76-19376*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
PREDICTION OF CRYOGENIC HEAT PIPE PERFORMANCE Annual Report, 1975
G. T. Colwell 1 Feb. 1976 78 p refs
(Grant NsG-2054)
(NASA-CR-146510; Rept-2) Avail: NTIS HC $5.00 CSCL 20D

A 304 stainless steel heat pipe with slab type capillary structure and nitrogen as the working fluid was studied in the temperature range of 60 K to 120 K. The pipe was 1.27 cm in outside diameter and 9.14 cm in total length. In the transient studies, described in detail in this report, saddles were included at evaporator and condenser ends and a radiator was included at the condenser end. Author

N76-19377*# TRW Systems Group, Redondo Beach, Calif.
FLIGHT DATA ANALYSIS AND FURTHER DEVELOPMENT OF VARIABLE-CONDUCTANCE HEAT PIPES
J. E. Enginer, E. E. Luedke, and D. J. Wanous Feb. 1976 177 p refs
(Contract NAS2-8310)
(NASA-CR-137782; RR-1; TRW-26263-6021-RU-00) Avail: NTIS HC $7.50 CSCL 20M

Continuing efforts in large gains in heat-pipe performance are reported. It was found that gas-controlled variable-conductance heat pipes can perform reliably for long periods in space and effectively provide temperature stabilization for spacecraft electronics. A solution was formulated that allows the control gas to vent through arterial heat-pipe walls, thus eliminating the problem of arterial failure under load, due to trace impurities of noncondensable gas trapped in an arterial bubble during priming. This solution functions well in zero gravity. Another solution

was found that allows priming at a much lower fluid charge. A heat pipe with high capacity, with close temperature control of the heat source and independent of large variations in sink temperature was fabricated. F.S.

N76-19378*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

FORMULATION AND CLOSURE OF COMPRESSIBLE TURBULENCE EQUATIONS IN THE LIGHT OF KINETIC THEORY

Shunichi Tsuge and Kenshi Sagara Feb. 1976 45 p refs
(Contract NAS2-8740)
(NASA-CR-137808; NEAR-TR-109) Avail: NTIS HC $4.00 CSCL 20D

Fluid-dynamic moment equations, based on a kinetic hierarchy system, are derived governing the interaction between turbulent and thermal fluctuations. The kinetic theory is shown to reduce the inherent complexity of the conventional formalism of compressible turbulence theory and to minimize arbitrariness in formulating the closure condition. F.S.

N76-19379*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYSTEM FOR MEASURING THREE FLUCTUATING VELOCITY COMPONENTS IN A TURBULENTLY FLOWING FLUID Patent Application

Dah Yu Cheng, inventor (to NASA) (Santa Clara Univ.) Filed 15 Mar. 1976 30 p Sponsored by NASA
(NASA-Case-ARC-10974-1; US-Patent-Appl-SN-667010) Avail: NTIS HC $4.00 CSCL 20D

A system for measuring fluid velocity in a turbulently flowing fluid includes a sensing apparatus for dynamically sensing the mainstream and two orthogonal cross velocity components of the fluid, and a transducer to provide three electrical output signals representative of the velocity components in the mainstream and in the cross directions. Signal processors can be utilized to derive the Reynolds stress wave and the Reynolds stress. NASA

N76-19380# Friedman (Morris D.), Inc., West Newton, Mass.

ALGORITHM OF THE INVESTIGATION OF PLASTIC RUPTURE OF A BODY BY A PRESSURE WAVE IN A FLUID

G. S. Pisarenko, Sh. U. Galiev, O. S. Tsibenko, and A. O. Pavlov 1976 6 p refs Transl. into ENGLISH from Dopovidi AN UkrSSR, Ser. A, Fiz.-Mat. ta Tekhn. Nauki (USSR), no. 1, 1976 p 52-56
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The rupture of a square steel plate during interaction with a pressure wave in a fluid was studied on the basis of an algorithm which determined the stress-strain rate of a body at the N-th step by using finite differences. Taken as a rupture was that state of the plate when the displacement of some of its adjacent points relative to each other started to exceed the initial spacing between points. Author

N76-19381*# Washington Univ., Seattle. Dept. of Mechanical Engineering.

FLOWFIELD ANALYSIS FOR SUCCESSIVE OBLIQUE SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTIONS

Chen-Chih Sun and Morris E. Childs Washington NASA Mar. 1976 111 p refs
(Grant NGR-48-002-047)
(NASA-CR-2656) Avail: NTIS HC $5.50 CSCL 20D

A computation procedure is described for predicting the flowfields which develop when successive interactions between oblique shock waves and a turbulent boundary layer occur. Such interactions may occur, for example, in engine inlets for supersonic aircraft. Computations are carried out for axisymmetric internal flows at M 3.82 and 2.82. The effect of boundary layer bleed is considered for the M 2.82 flow. A control volume analysis is used to predict changes in the flow field across the interactions. Two bleed flow models have been considered. A turbulent boundary layer program is used to compute changes in the boundary layer between the interactions. The results given are for flows with two shock wave interactions and for bleed at the second interaction site. In principle the method described may be extended to account for additional interactions. The predicted results are compared with measured results and are shown to be in good agreement when the bleed flow rate is low (on the order of 3% of the boundary layer mass flow), or when there is no bleed. As the bleed flow rate is increased, differences between the predicted and measured results become larger. Shortcomings of the bleed flow models at higher bleed flow rates are discussed. Author

N76-19382# Argonne National Lab., Ill.

APPLICATION OF THE COLLOCATION METHOD USING HERMITE CUBIC SPLINES TO NONLINEAR TRANSIENT ONE-DIMENSIONAL HEAT-CONDUCTION PROBLEMS

T. C. Chawla, G. Leaf, W. L. Chen, and M. A. Grolmes Jul. 1975 36 p refs
(Contract W-31-109-eng-38)
(ANL-75-33) Avail: NTIS HC $4.00

A collocation method for the solution of one-dimensional parabolic partial differential equations using Hermite splines as approximating functions and Gaussian quadrature points as collocation points is described. The method consists of expanding dependent variables in terms of piecewise cubic Hermite splines in the space variable at each time step. The unknown coefficients in the expansion are obtained at every time step by requiring that the resultant differential equation be satisfied at a number of points (in particular, at the Gaussian quadrature points) in the field equal to the number of unknown coefficients. This collocation procedure reduces the partial differential equation to a system of ordinary differential equations which is solved as an initial-value problem using the steady-state solution as the initial condition. The method thus developed is applied to a two-region nonlinear transient heat-conduction problem and compared with a finite-difference method. Author (NSA)

N76-19383# California Univ., Berkeley. Dept. of Mechanical Engineering.

LASER VELOCIMETER STUDY OF ENTRANCE FLOWS IN CURVED PIPES

Yogesh Chandra Agrawal Jan. 1975 134 p refs
(Grant NSF ENG-73-03970-A01)
(PB-245215/9; FM-75-1) Avail: NTIS HC $6.00 CSCL 20D

Experimental investigation of the development of flow of steady, laminar, incompressible, Newtonian fluids in curved pipes is reported. The entry condition investigated is one of uniform irrotational motion. Two semi-circular pipes of radius ratios 1/2 and 1/7 were employ covering a Dean's number range from 139 to 565. Streamwise velocity and the component of secondary velocity in the plane of the pipe were measured using a Laser Doppler Velocimeter developed for the purpose. It is observed that the entry region is divided in two parts. GRA

N76-19384# Missouri Univ., Columbia. Dept. of Chemistry.

STUDIES OF ENERGY AND MOMENTUM EXCHANGE BETWEEN SOLIDS AND GASES Final Report, 1 Jul. 1972 - 30 Jun. 1975

Lloyd B. Thomas 30 Jun. 1975 13 p
(Grant AF-AFOSR-2440-73)
(AD-A015844; AFOSR-75-1439TR) Avail: NTIS CSCL 07/4

This report briefly describes the results of three years research under the given title. Topics briefly described are: Experimental basis for test and development of the kinetic theory of heat conduction by gases; measurement of tangential momentum accommodation on controlled surfaces; temperature distribution and heat flow from filaments; and the McLeod gauge mercury pumping error. The publications made as a result of the work are listed. GRA

N76-19385# California Univ., Davis. Water Resources Center.

FINITE ELEMENT SOLUTIONS FOR UNSTEADY AND UNSATURATED FLOW IN POROUS MEDIA

John C. Bruch, Jr. Aug. 1975 30 p refs Prepared in cooperation with Calif. Univ., Santa Barbara
(PB-245764/6; Contrib-151; W76-00177; OWRT-A-039-CAL(10)) Avail: NTIS HC $4.00 CSCL 20D

A finite element, weighted residual, successive substitution algorithm has been used to solve two dimensional infiltration

problems whose governing partial differential equation and boundary conditions are highly nonlinear. The results compared favorably with other published numerical solutions to similar examples. The soil water diffusivity, as well as the capillary conductivity, were approximated within a finite element in terms of shape functions and discretized values of these functions calculated using guessed values or previously calculated values at a certain time level of the water content at the nodes. This successive substitution scheme converged rapidly within each time step. GRA

N76-19386# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
LIQUID FILM THICKNESS TESTS: WET STREAM TUNNEL
F. G. Hammitt, J. B. Hwang, A. Mancuso, D. Krause, and S. Blome Jun. 1975 54 p refs
(Grant NSF GK-40130)
(PB-246059/0; UMICH-012449-9-T) Avail: NTIS HC $4.50 CSCL 20D

Measured liquid film thicknesses along a flat blade immersed in high velocity (to Mach 1), low pressure (3 psia), wet steam flow (wetness 5%), wherein water is injected through a transverse slit near the blade leading edge, are compared with film thickness predictions based upon the interfacial shear between steam and liquid flows. Tests are made for both adiabatic and diabatic (cold water injection) conditions. Good qualitative agreement is achieved, although a discrepancy is reported between measured and predicted film thicknesses. GRA

N76-19387# Scientific Research Associates, Inc., Rockville, Md.
THE OSCILLATION OF SHORT IMMERSED FLUID-FILLED HOSES
Albert A. Hudimac 9 Oct. 1975 25 p ref
(Contract N00014-70-C-0378)
(AD-A016623; Rept-75-2) Avail: NTIS CSCL 20/4

Longitudinal oscillations in a towed array can be reduced by introducing an alternation of masses and short fluid-filled hoses. The pressure fields inside and outside of the hose are obtained by solving a boundary value problem with mixed boundary condition. An equivalent T section representation of the hose is given which can be used in calculating the filtering action of the iterated structure. Author (GRA)

N76-19388# Pennsylvania State Univ., University Park. Applied Research Lab.
AN EXPERIMENTAL INVESTIGATION OF ARTIFICIALLY INDUCED TRANSITION TO TURBULENCE ON A BODY OF REVOLUTION M.S. Thesis
William F. Shivitz 11 Jun. 1975 122 p refs
(Contract N00017-73-C-1418)
(AD-A016616; TM-75-178) Avail: NTIS CSCL 20/4

Transition to turbulence in a boundary layer continues to be a topic of considerable interest to both aerodynamicists and hydrodynamicists. The present study focuses on the particular aspect of the problem pertaining to transition zone characteristics induced by a circular trip wire located upstream of the point of instability on a blunt nosed body of revolution. The actual transition to turbulence occurs in a region of adverse pressure gradient. The study was made on an eight-inch diameter body of revolution which had a blunt nose faired to a cylindrical afterbody with a modified ellipsoid contour. The velocity field was measured with hot-wire sensors and analyzed using analog techniques to determine velocity, intermittency, spatial correlation, and spectral characteristics. Transition to turbulence was found to be very sensitive to trip wire diameter and location and to the free-stream Reynolds number. Certain of the high amplitude instability waves induced by the trip mechanism were observed to be selectively amplified into transition in a manner similar to that predicted by stability theory. Secondary instabilities were observed to contribute to the transition process. Cross spectral densities were measured for the bursts moving downstream to determine if any narrowband range of frequencies were present which could contribute to far-field noise radiated from the boundary layer. A one-third octave filter was used to determine spectral velocity fluctuation concentrations of the bursts at a location within the transition region and compared to similar concentrations at a fully turbulent location. Author (GRA)

N76-19389# Naval Postgraduate School, Monterey, Calif.
UNSTEADY SUPERSONIC CASCADE THEORY INCLUDING NONLINEAR THICKNESS EFFECTS M.S. Thesis
William Richard Chadwick Jun. 1975 133 p refs
(AD-A016570) Avail: NTIS CSCL 20/4

Several problems are treated which arise in the study of generalized airforces in unsteady supersonic cascades having subsonic axial velocity. The finite cascade of oscillating wedges involving thickness is first solved numerically. There is some indication that thickness effects are reduced by cascading. Next, the finite cascade of oscillating flat plates is solved analytically, to the third power of oscillation frequency. For comparison with the finite cascade, there is presented finally an elementary periodic solution for the infinite cascade. A simple relationship between the two basic cascade models is developed. GRA

N76-19390# Johns Hopkins Univ., Baltimore, Md. Geophysical Fluid Dynamics Lab.
TURBULENT ENTRAINMENT AT THE DENSITY INTERFACE OF A TWO-LAYER STABLY STRATIFIED FLUID SYSTEM Interim Report
Lakshami H. Kantha Aug. 1975 168 p refs
(Contract N00014-75-C-0700; Grant NSF DES-72-01549; NR Proj. 083-016)
(AD-A016607; GFD-Lab-TR-75-1) Avail: NTIS CSCL 20/4

The report deals with entrainment at the density interface of a stable two-layer stratified fluid, resulting from the application and maintenance of a constant shear stress at the top of the upper layer. The investigation is the continuation of turbulence experiments reported earlier by Kato and Phillips (1969). The results seem to resolve the existing controversy on which Richardson number law the entrainment should follow. GRA

N76-19391# Avco Systems Div., Wilmington, Mass.
EXPLORATORY DEVELOPMENT OF HYPERSONIC HEAT TRANSFER AND THERMOMECHANICAL ABLATION OF ADVANCED MATERIALS: REVIEW OF EUROPEAN PROGRESS Final Report, Apr. 1972 - Mar. 1975
Torstein K. Fannelop Apr. 1975 58 p refs
(Contract F33615-72-C-1803; AF Proj. 7381)
(AD-A016783; AFML-TR-75-25-Vol-2) Avail: NTIS CSCL 20/4

The overall program study was in three specific areas: (1) evaluation of wind tunnel test data, (2) rough wall boundary layer transition, and (3) review of European turbulent boundary layer state of the art. The first two topics are included in Volume I and the last topic comprises Volume II. The study presented in Volume II is a result of a subcontract with the Aeronautical Research Institute of Sweden to review current European progress in turbulent boundary layer prediction methods. In particular, work related to nosetip boundary layer phenomenology, including the effects of roughness, body curvature, separation, and reattachment are discussed. GRA

N76-19392# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Theoretical Aerodynamics Research Lab.
WIND TUNNEL TESTS OF A NEW DIFFUSER CONCEPT Interim Technical Report, Sep. 1974 - May 1975
James S. Petty Jun. 1975 33 p refs
(AF Proj. 7064)
(AD-A016728; ARL-75-0198) Avail: NTIS CSCL 20/4

Tests were conducted in the ARL 3 in. by 3 in. Mach 3 wind tunnel facility of a new variable geometry diffuser concept. This gas wedge diffuser incorporates controlled large flow separation regions as compression surfaces in place of solid surfaces. Test results indicate stable flow in the device and expected pressure recovery considerably in excess of normal shock recovery. GRA

N76-19393# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
DRAG REDUCTION IN TURBULENT FLOW OF POLYMER SOLUTIONS Final Report, 1 Sep. 1969 - 31 Aug. 1975
Edward W. Merrill, K. A. Smith, and R. C. Armstrong 24 Oct. 1975 148 p refs
(N00014-67-A-0204-0037)
(AD-A017105; CED-DR-75-2) Avail: NTIS CSCL 07/4

Polyelectrolytes as drag reducing agents were studied; abnormal effects occurred only in dilute aqueous solutions free of added electrolyte. Extensional flows of polyisobutylene observed by light scattering indicate greater elongation than in shear flow, but work is unfinished. Onset of drag reduction studied with 'monodisperse' poly cis isoprene solutions indicate time based hypothesis gives better correlation than length based hypothesis and that there may be two different onset levels. GRA

N76-19118* Avco-Everett Research Lab., Everett, Mass.
MOTIONS OF A LIQUID IN A PULSATING BULB WITH APPLICATION TO PROBLEMS OF BLOOD FLOW
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 957-965 refs Sponsored in part by Navy (For availability see N76-19059 10-02)
CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-19394 Illinois Univ., Urbana.
THEORETICAL AND INSTRUMENTAL DEVELOPMENT OF A DUAL WAVELENGTH SPECTROPHOTOMETRIC INSTRUMENT FOR EQUILIBRIUM METHODS OF ANALYSIS Ph.D. Thesis
Kenneth Lloyd Ratzlaff 1975 188 p
Avail: Univ. Microfilms Order No. 76-6915

The basic relationships of dual wavelength spectrophotometry are presented and instrumental errors are eloborated. Among errors in accuracy, the most significant are those arising from stray light and from a finite slit width. The theoretical absorbance curves and error curves are presented. A computer controlled dual cell/dual wavelength spectrophotometry instrument is described which is constructed by the modification of a commercially available dual cell instrument. Data are presented showing the overall accuracy and linearity of the instrument and showing that precision is photon limited until the light intensity is sufficient for the precision to be source flicker limited. Experimental verification of the theoretical treatments of stray light and slit width errors is also presented. Dissert. Abstr.

N76-19395 Cincinnati Univ., Ohio.
ENHANCEMENT OF RADIONUCLIDE IMAGES BY THE METHOD OF HOLOGRAPHIC FOURIER TRANSFORMATION Ph.D. Thesis
Thomas N. Padikal 1975 105 p
Avail: Univ. Microfilms Order No. 76-5977

Enhancement of radionuclide images is achieved by holographic Fourier transform techniques. The optical deconvolution method uses the impulse response of the camera as the fundamental parameter. Based on the linear theory of image formation, an enhancement filter is developed to enhance the resolution of scintigrams. Results of this investigation show that an ordinary scintigram is corrupted by noise, as well as the system point spread function; for example, measurements in the Fourier transform domain show that about 20% of the energy is carried by noise of one kind or another. Results obtained after processing indicate that the return is good. For instance, the signal-to-noise ratio may be increased by an order of magnitude or so, and the processed image field is more amenable to information extraction than even the image taken with a high resolution collimator. Dissert. Abstr.

N76-19396 Michigan State Univ., East Lansing.
DEVELOPMENT, CHARACTERIZATION, AND APPLICATIONS OF A COMPUTER-CONTROLLED SILICON VIDICON SPECTROMETER Ph.D. Thesis
Timothy Alan Nieman 1975 295 p
Avail: Univ. Microfilms Order No. 76-5614

A computer controlled rapid scan spectrometer has been developed which uses a silicon vidicon tube as a multichannel detector. The spectrometer can monitor a 230nm window in the range of 380-900 nm with 4.2 nm resolution and wavelength linearity better than 0.3 percent. Spectrum scan times as fast as 2 milliseconds are possible. Under computer control the wavelength window can be divided into between 32 and 4,096 wavelength channels. The tube readout beam can be deflected to any channel at random or made to scan them sequentially. The readout beam can be inhibited from scanning any channel, to increase the target's integration time and enhance weak signals. Dissert. Abstr.

N76-19397 Illinois Univ., Urbana.
A DEMULTIPLEXER FOR USE WITH THE DYNAMIC CROSSED-FIELD PHOTOMULTIPLIER Ph.D. Thesis
Stuart Milton Abbott 1975 116 p
Avail: Univ. Microfilms Order No. 76-6674

A mechanism was investigated which would permit time division demultiplexing of the output of a Dynamic Crossed-Field Photomultiplier (DCFP). The mechanism would be an integral part of the device. Demultiplexing is achieved with the use of a crossed field deflection mechanism which directs electron bunches to any one of a set of microstrip collectors. The deflection mechanism uses a divided drift region, consisting of a gap and an active drift region. A dc electric field in the gap injects electron bunches, emitted from the DCFP multiplication region, into the active drift region. In the active drift region, dc and RF electric fields are used to direct each electron bunch to a broadband collector structure. The collectors are 50 ohm shielded microstrips, terminated in an open circuit. The deflection mechanism has been modeled and its deflection characteristics studied as a function of all relevant field and structural parameters. Dissert. Abstr.

N76-19398*# Linguistic Systems, Inc., Cambridge, Mass.
SPECTROSCOPY: REQUISITES FOR STIGMATISM IN ARRANGEMENTS WITH SIMPLE ROTATION OF A GRATING EQUIPPED WITH CONCAVE HOLOGRAPHIC GRATINGS
Michel Pouey Washington NASA Feb. 1976 9 p refs Transl. into ENGLISH from Compt. Rend., Ser. B (Paris), v. 277, no. 16, 22 Oct. 1973 p 459-462
(Contract NASw-2482)
(NASA-TT-F-16707) Avail: NTIS HC $3.50 CSCL 20F

Necessary conditions, derived from equations based on Fermat's principle, that will correct astigmatism in arrangements with simple rotation of a concave grating are given. Using a specific case, data show that total compensation for astigmatism can be obtained at 2,500 A under conditions realized in practice. Author

N76-19399# National Aerospace Lab., Tokyo (Japan).
INFLUENCE OF THERMOCOUPLE ON TEMPERATURE FIELDS
Hideaki Nishimura Jul. 1975 31 p refs In JAPANESE; ENGLISH summary
(NAL-TR-414) Avail: NTIS HC $4.00

Thermocouples are widely used for measuring temperature. However, there are some possible errors which may be caused by the heat conduction of a thermocouple itself, radiation from its surroundings, defects and/or defective instrumentation of the thermocouple, and for other reasons. An analogy is used between temperature and electric potential fields. Carbon-paper i.e. Teledeltus paper was used for making the analogical model. Local nonuniformity of the thermal conductance in the temperature field was simulated in the electric field by distributing small holes and/or applying electric conductor paints on the carbon-paper. The physical boundary-conditions, such as distributions of heat transfer rate, and temperatures at the outer edge of flow boundary layers, were also simulated by the electric resistance and potential distributions on the boundary of the model. Measurements were made for a practical model of an air-cooled airfoil with 14 thermocouples. The results of the measurements are given, and the influences are discussed. Author

N76-19400*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER VELOCIMETER WAKE VORTEX TESTS Final Report
J. W. Bilbro, H. B. Jeffreys, E. A. Weaver, R. M. Huffaker, G. D. Craig, R. W. George, and P. J. Marrero Mar. 1976 153 p refs Sponsored in part by DOT Document includes a Microfiche supplement
(NASA-TM-X-64988; FAA-RD-76-11) Avail: NTIS HC $6.75 CSCL 14B

A scanning laser Doppler velocimeter (SLDV) was installed at John F. Kennedy (JFK) International Airport and was operated for six months collecting data on vortices generated by landing aircraft. A description of the SLDV system, a summary of the JFK test operations, an analysis of selected portions of the data, and recommendations for improvements to the SLDV are presented. The vortex information, including track and velocity data, on over 1,600 aircraft landings is contained in the appendices. Author

N76-19401*# Los Alamos Scientific Lab., N.Mex.
WORK FUNCTION DETERMINATION OF PROMISING ELECTRODE MATERIALS FOR THERMIONIC ENERGY CONVERTERS Semiannual Report, Jul. 1975 - Jan. 1976
Dean Jacobson, Ed Storms, Bob Skaggs, Tom Kouts (Arizona State Univ.), Jim Jaskie (Arizona State Univ.), and Mike Manda (Arizona State Univ.) Jan. 1976 38 p refs
(Grant NsG-7019)
(NASA-CR-146499) Avail: NTIS HC $4.00 CSCL 14B

The work function determinations of candidate materials for low temperature (1400 K) thermionics through vacuum emission tests are discussed. Two systems, a vacuum emission test vehicle and a thermionic emission microscope are used for emission measurements. Some nickel and cobalt based super alloys were preliminarily examined. High temperature physical properties and corrosion behavior of some super alloy candidates are presented. The corrosion behavior of sodium is of particular interest since topping cycles might use sodium heat transfer loops. A Marchuk tube was designed for plasma discharge studies with the carbide and possibly some super alloy samples. A series of metal carbides and other alloys were fabricated and tested in a special high temperature mass spectrometer. This information coupled with work function determinations was evaluated in an attempt to learn how electron bonding occurs in transition alloys. Author

N76-19402*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PULSE HEIGHT RESPONSE OF AN OPTICAL PARTICLE COUNTER TO MONODISPERSE AEROSOLS
R. G. Wilmoth, S. S. Grice, and V. Cuda Mar. 1976 30 p refs
(NASA-TM-X-72812) Avail: NTIS HC $4.00 CSCL 14B

The pulse height response of a right angle scattering optical particle counter has been investigated using monodisperse aerosols of polystyrene latex spheres, di-octyl phthalate and methylene blue. The results confirm previous measurements for the variation of mean pulse height as a function of particle diameter and show good agreement with the relative response predicted by Mie scattering theory. Measured cumulative pulse height distributions were found to fit reasonably well to a log normal distribution with a minimum geometric standard deviation of about 1.4 for particle diameters greater than about 2 micrometers. The geometric standard deviation was found to increase significantly with decreasing particle diameter. Author

N76-19403*# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
ADVANCED PROTOTYPE AUTOMATED IODINE MONITOR SYSTEM Final Report
Jan. 1976 101 p refs
(Contract NAS9-14761)
(NASA-CR-147492; FR-1203-101) Avail: NTIS HC $5.50 CSCL 14B

The technique of detecting and measuring parts-per-million concentrations of aqueous iodine by direct spectrophotometric means is discussed, and development of a prototype Automated Iodine Monitoring/Controller System (AIMS) is elaborated. The present effort is directed primarily toward reducing the power requirement and the weight of the AIMS. Other objectives include determining the maximum concentration of iodine that can be dissolved in an alcohol solution, and in an aqueous potassium iodide solution. Also discussed are the effects of a no flow condition on iodine measurements and the effect of pH on spectrophotometric iodine determinations. Author

N76-19404*# Scientific Translation Service, Santa Barbara, Calif.
PRINCIPLES OF OBJECTIVE AND DYNAMIC ESTABLISHMENT OF THE INTERNATIONAL RADIOMETRIC BASE
D. Crommelynck Washington NASA Mar. 1976 18 p refs Transl. into ENGLISH from "Principes pour la Materialisation Objective et Dynamique de la Base Radiometrique Internationale" (USSR), Preprint, 1976 p 1-10
(Contract NASw-2791)
(NASA-TT-F-16973) Avail: NTIS HC $3.50 CSCL 14B

A general discussion of the incorporation of radiometers into an international radiometric base is reported. Author

N76-19405*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SEMICONDUCTOR PROJECTILE IMPACT DETECTOR Patent Application
Edward L. Shriver, inventor (to NASA) Filed 11 Mar. 1976 11 p
(NASA-Case-MFS-23008-1; US-Patent-Appl-SN-665734) Avail: NTIS HC $3.50 CSCL 14B

A semiconductor projectile impact detector is reported for use in determining micrometeorite presence as well as its flux and energy. The device comprises a photovoltaic cell which generates a voltage according to the light and heat emitted by the micrometeorites upon impact with the cell. A counter and a peak amplitude measuring device are used to indicate the number of particles which strike the surface of the cell as well as the kinetic energy of each of the particles. NASA

N76-19406*# North Carolina State Univ., Raleigh. Solid State Lab.
DEVELOPMENT OF A THIN FILM SOLID STATE GASEOUS HCl SENSOR
[1975] 54 p refs
(Contract NAS1-12833)
(NASA-CR-144954) Avail: NTIS HC $4.50 CSCL 14B

The selection of materials to develop a thin film HCl sensor is discussed. Data were primarily concerned with chemical and physical properties of the film and with electrical properties which exhibit and enhance electrical response when HCl is absorbed on the film surface. Techniques investigated for enhancing electrical response include changing conditions for growing films, adding impurities to the film, changing ambient light intensity, and altering the ambient temperature of the sensing element. Author

N76-19407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCOUPLES OF MOLYBDENUM AND IRIDIUM ALLOYS FOR MORE STABLE VACUUM-HIGH TEMPERATURE PERFORMANCE Patent Application
James F. Morris, inventor (to NASA) Filed 18 Mar. 1976 14 p
(NASA-Case-LEW-12174-1; US-Patent-Appl-SN-667929) Avail: NTIS HC $3.50 CSCL 14B

Thermocouples that provide stability and performance reliability in systems involving high temperatures and vacuums are presented: the device employs a bimetallic thermocouple sensor where each metal of the sensor is selected from a group of metals comprising molybdenum and iridium and alloys containing only those two metals. The molybdenum, iridium thermocouple sensor alloys provide bare metal thermocouple sensors with advantageous vapor pressure compatibilities and performance characteristics. The compatibility and physical characteristics of the thermocouple sensor alloys result in improved emf, temperature properties and thermocouple hot junction performance. Thermocouples formed of the molybdenum, iridium alloys are adaptable to space propulsion and power systems and nuclear environments. NASA

N76-19408*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CAMERA ARRANGEMENT Patent Application
Robert F. Hummer (Santa Barbara Res. Center) and Deane T. Upton, inventors (to NASA) (Santa Barbara Res. Center) Filed 19 May 1975 21 p
(Contract NAS5-9677)
(NASA-Case-GSC-12032-2; US-Patent-Appl-SN-578700) Avail: NTIS HC $3.50 CSCL 14E

An aerial vehicle rotating in gyroscopic fashion about one of its axes is described. An optical system is present at the rotation site and operates to scan an area below the vehicle in determined relation to vehicle rotation. A sensing device is provided to sense the physical condition of the area of scan and optical means are present to direct the physical intelligence received from the scan area to the sensing means. Methods are provided to incrementally move the optical system through a series of steps to effect sequential line scan of the area being viewed and keyed to the rotational rate of the vehicle. NASA

N76-19409*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TACHOMETER Patent Application
Frank J. Nola, inventor (to NASA) Filed 18 Mar. 1976 11 p
(NASA-Case-MFS-23175-1; US-Patent-Appl-SN-667928) Avail: NTIS HC $3.50 CSCL 14B

A description is given of a tachometer in which sine and cosine signals responsive to the angular position of a shaft as it rotates are each multiplied by like, sine or cosine, functions of a carrier signal, and the products summed: the resulting frequency signal is converted to fixed height and fixed width pulses of a like frequency. These pulses are the integrated, and the resulting dc output is an indication of shaft speed. NASA

N76-19410# Tubingen Univ. (West Germany). Astronomisches Inst.
OPTICAL INTEGRATION METHODS FOR PHOTOGRAPHIC IMAGE NOISE REDUCTION APPLIED TO X-RAY ASTRONOMY [OPTISCHE INTEGRATIONSMETHODEN ZUR REDUZIERUNG DES RAUSCHENS PHOTOGRAPHISCHER BILDER UND EINE ROENTGENASTRONOMISCHE ANWENDUNG]
Hans J. Einighammer Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1975 90 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(Contract BMFT-WRK-172)
(BMFT-FB-W-75-12) Avail: NTIS HC $5.00; ZLDI, Munich DM 18.90

The principle of improving the signal to noise ratio by averaging signals of the same kind were applied to photographic images. When X-ray sources are imaged with pinholes or zone plates, they are taken simultaneously with a matrix camera. The superposition was obtained by means of a lens matrix or a hologram of the objective matrix of the X-ray camera. The law of reduction of the relative intensity fluctuations in the integrated image was verified. Autocorrelation functions of film and integrated image were compared. The sun was imaged in the soft X-ray region with a pinhole matrix camera (N = 96), borne by a sounding rocket. The image matrix obtained was decoded by both procedures. The dimensions of a pinhole matrix camera for solar X-ray flares to be imaged at lambda = 1.9 angstrom were estimated. Author (ESA)

N76-19411# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
SURVEY AND ASSESSMENT OF POSSIBILITIES TO DEFLECT OR SWEEP THE FIELD OF VIEW BY NON-MECHANICAL MEANS Final Report
G. Scrivener and P. Waterworth Oct. 1975 73 p refs
(Contract ESTEC-2213/74-AK)
(CD.6500606/K; ESA-CR(P)-747) Avail: NTIS HC $4.50

Techniques likely to yield a non-mechanical or micromechanical light beam deflection system are reviewed. Topics studied include thermal effects, electro-optic effects, magnetooptical light deflection, acousto-optics, and micromechanical techniques. The electro-optic techniques include Kerr effect, Pockels effect, refraction deflectors, digital light deflectors, Fabry-Perot deflector, and Franz-Keldysh deflector. It is concluded that the micromechanical systems are the most promising for satellite use, followed by acousto-optic and electro-optic deflection systems. ESA

N76-19412# Kent State Univ., Ohio. Dept. of Physics.
SPARK CHAMBER SPECTROMETRY AND SPACE RADIATION STUDIES, 3 Final Report, 1 Apr. 1972 - 30 Jun. 1975
Richard Madey and Alan R. Baldwin 31 Oct. 1975 70 p refs
(Contract F19628-72-C-0204; AF Proj. 8600)
(AD-A016766; KSUPD-75-3; AFCRL-TR-75-0441) Avail: NTIS CSCL 18/4

A portable spark-chamber range-spectrometer and electronic data acquisition system is described for acquiring spectral data on energetic charged particles. The instrument system consists of a unidirectional spark-chamber range telescope with pulse-height analysis of the specific-energy loss (dE/dx) of a charged particle that passes through a triggering telescope. The range telescope consists of a stack of sealed double-gap spark-discharge modules with absorbers sandwiched between them. A Cerenkov counter discriminates against electrons and muons. Cerenkov and dE/dx signals are gated by the coincidence circuit. Data, either telemetered or recorded in situ, include the number of coincidences, a clock signal, system voltage levels, and the dE/dx, Cerenkov, and spark-discharge module signals. Power consumption of the self-contained system is about 10 watts at an event rate of 20 per second and 17 watts at an event rate of 100 per second. The standby power is about 8 watts. This instrument system can measure primary protons and alphas at balloon altitudes and secondary protons at lower altitudes. GRA

N76-19413# Michigan Univ., Ann Arbor. Interferometry Lab.
QUANTITATIVE INTERPRETATION OF MULTI-DIRECTIONAL HOLOGRAPHIC INTERFEROMETRY Final Report, 1 Feb. 1974 - 31 Jul. 1975
Charles M. Vest and P. T. Radulovic Oct. 1975 135 p refs
(Contract N00014-67-A-0181-0057; Grant NSF GK-41778)
(AD-A017596; INTFL-7501) Avail: NTIS CSCL 20/6

This final technical report on quantitative interpretation of multidirectional holographic interferometry contains summaries of a number of specific investigations conducted in the Department of Mechanical Engineering, The University of Michigan. The primary objective of this research is the minimization of data required to obtain complete three-dimensional density information from wind tunnel holographic interferometry tests on arbitrary models. The investigations described herein are: (1) The theory of reconstruction of functions from their projections was reviewed and evaluated in the context of application to holographic interferometric data of the type used for wind tunnel diagnostics; (2) Using computer-simulated experimental data, several algorithms for data analysis were compared; (3) A study of direct three-dimensional reconstruction of density fields, as opposed to reconstruction of the fields on a set of cross-sectional planes, was conducted; (4) The use of a priori knowledge of the physical structure of the field being measured was considered; (5) The problems associated with refraction of probing optical rays were studied; (6) Experimental work of limited scope was carried out. A study of illumination schemes for multi-directional holographic interferometers resulted in the design of a holographic phase grating for generating several plane waves of high optical quality, each propagating in a different direction. GRA

N76-19414# Utah State Univ., Logan.
DEVELOPMENT OF A LIQUID-HELIUM COOLED ROCKET-BORNE SPECTROMETER Electro-Dynamics Lab.
Clair L. Wyatt and Doran J. Baker L. G. Hanscom Field, Mass. AFCRL Feb. 1975 41 p refs
(Contract F19628-73-C-0048; AF Proj. 6813; DNA Proj. NWET-K11BAXHX534)
(AD-A017207; AFCRL-TR-75-0164, SR-2) Avail: NTIS CSCL 17/5

An infrared spectrometer used to obtain atmospheric emission spectra from a rocket at altitudes between 45 and 200 km in the ICECAP Auroral Measurements Program is described. The instrument continuously scanned the 6.75-23.2 micrometers spectral region at the rate of 2 scans per second. The instrument resolution of the spectrometer, which employed a circular-variable interference filter (CVF), ranged from 3 to 4 percent. GRA

N76-19415# Visidyne, Inc., Burlington, Mass.
THE DESIGN AND FLIGHT TEST OF A 30 kW ROCKET-BORNE ELECTRON ACCELERATOR MODULE (EXCEDE 2 TEST) HAES REPORT NUMBER 22 Final Report, 23 Dec. 1974 - 31 Jul. 1975
O. Shepherd, J. W. Carpenter, W. P. Reidy, W. A. Sheehan, and T. F. Zehnpfennig L. G. Hanscom Field, Mass. AFCRL 15 Jul. 1975 130 p refs
(Contract F19628-75-C-0115; DNA Proj. NWET-L25AAXHX632)
(AD-A016563; VI-289; AFCRL-TR-75-0379) Avail: NTIS CSCL 20/7

A 30 kw, 3 kV rocket-borne electron accelerator was designed, fabricated, tested and launched from the Poker Flat Research Range as part of the EXCEDE Program. Additional rocket-borne and ground instrumentation provided diagnostic information to evaluate accelerator performance. The high voltage power supply and electron guns were designed specifically for high power deposition. This engineering test demonstrated the accelerator met its design criterion. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-19416 Illinois Univ., Urbana.
HIGH QUALITY TEA CARBON DIOXIDE LASER AND APPLICATIONS TO NONLINEAR OPTICS AND LASER DAMAGE Ph.D. Thesis
Donald Frederick Parsons 1975 147 p
Avail: Univ. Microfilms Order No. 76-6901

The theory of tunable stimulated Raman scattering from polaritons in zincblende semiconductors such as GaAs or CdTe is employed in the design of a high power continuously tunable oscillator using a high power pulsed CO2 laser for the pumping source. With a 10.6 micrometer pump wavelength, a signal around 11 micrometer and an idler in the 150 micrometer to 900 micrometer range can be produced with GaAs. The FIR refractive index of GaAs was accurately measured with a Fourier spectrophotometer and combined with NIR values to determine the angle tuning curve. The signal gain is computed as a function of input power density and idler frequency. A simple cavity model shows oscillation is possible in GaAs and CdTe while using a power density below the laser damage threshold of the crystal. Although signs of signal output have been detected, damage after several shots has prevented optimization of the cavity alignment to obtain a high power signal. Dissert. Abstr.

N76-19417 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
VISIBLE CW AND LONG-PULSE LASING IN S 2 AND S 3 Ph.D. Thesis
Robert Allen Dessert 1974 257 p
Avail: Univ. Microfilms Order No. 76-6503

The sulfur ion laser is investigated in three slotted hollow cathode and two positive column laser (PCL) configurations. Laser action was achieved only in the PCL configurations. In the 1.76-mm diameter x 500-mm long laser, true CW operation was achieved on 9 transitions in S2 for periods up to 46 seconds. The lack of adequate thermal dissipation from the PCL capillary precluded operation for longer periods. CW operation was achieved on 5321-, 5346-, 5429-, 5433-, 5454-, 5474-, 5510-, 5640-, and 5647-A at a discharge current of 1 amp using Ne buffer gas at 5.6 torr flowing over sulfur crystals at 97 C at 5.6 torr cc sec/1. Dissert. Abstr.

N76-19418 Illinois Univ., Urbana.
A VERSATILE TUNABLE DYE LASER FOR SPECTROCHEMICAL FLUORESCENCE METHODS Ph.D. Thesis
David Calvin Harrington 1975 163 p
Avail: Univ. Microfilms Order No. 76-6780

A versatile tunable dye laser system is presented. The system is multipurpose in its operation and suitable for application to spectrochemical fluorescence methods of investigation. The basic characteristics and principles necessary for the construction and operation of a tunable dye laser are discussed. General considerations are cited in order to evaluate necessary components needed for the tunable dye laser system, including the optical pumping source and the size and complexity of the dye optical cavity. Dissert. Abstr.

N76-19419*# Phaser Telepropulsion, Inc., Los Angeles, Calif.
PERFORMANCE ANALYSIS OF A LASER PROPELLED INTERORBITAL TANSFER VEHICLE Final Report, 24 Jun. 1974 - 31 May 1975
M. A. Minovitch Feb. 1976 143 p refs
(Contract NAS3-18536)
(NASA-CR-134966; Rept-2M833) Avail: NTIS HC $6.00 CSCL 21C

Performance capabilities of a laser-propelled interorbital transfer vehicle receiving propulsive power from one ground-based transmitter was investigated. The laser transmits propulsive energy to the vehicle during successive station fly-overs. By applying a series of these propulsive maneuvers, large payloads can be economically transferred between low earth orbits and synchronous orbits. Operations involving the injection of large payloads onto escape trajectories are also studied. The duration of each successive engine burn must be carefully timed so that the vehicle reappears over the laser station to receive additional propulsive power within the shortest possible time. The analytical solution for determining these time intervals is presented, as is a solution to the problem of determining maximum injection payloads. Parameteric computer analysis based on these optimization studies is presented. The results show that relatively low beam powers, on the order of 50 MW to 60 MW, produce significant performance capabilities. Author

N76-19420# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
LONGITUDINAL MODE BEAT INTENSITIES IN A CW HF CHEMICAL LASER
L. P. Wang and R. L. Varwig 19 Feb. 1976 27 p refs
(ATR-76(8204)-2) Avail: NTIS HC $4.00

A simple expression was derived that describes the variation of beat intensity with tuning frequency. Experimental observations of the variation of beat intensity with tuning frequency in an HF chemical laser agree with the theoretical prediction. Author

N76-19421# Los Alamos Scientific Lab., N.Mex.
LASER PROGRAM AT LASL Progress Report, 1 Jan. - 30 Jun. 1975
F. Skoberne, Comp. Jan. 1976 160 p refs
(Contract W-7405-eng-36)
(LA-6050-PR) Avail: NTIS HC $7.75

Progress in the development of high-power lasers for fusion application was reported. Modifications to the Nd: glass system are described, and studies relating to specific problems of this system are summarized. Efforts in the development of a powerful CO2 laser system are outlined, leading from a 1-kJ laser to a 2.5-kj system and subsequently to a 10-kJ assembly. Results of experiments with the cold-cathode electron gun to be used in the 2.5-jK system are given. Preliminary design criteria for a high-energy laser facility to accommodate an advanced CO2 laser system with a nominal energy output of 100 kJ are discussed. New methods of fabricating complex laser targets are summarized, and novel coating and inspection techniques are outlined. Computer-code modifications and developments are discussed which integrate some of the phenomena observed in laser/target interaction experiments. Applications of laser fusion other than the direct production of electric power, e.g., the production of synthetic fuels, are discussed. Author

N76-19422# Friedman (Morris D.), Inc., West Newton, Mass.
MEASUREMENT OF THE REFLEXIVITY OF DIELECTRICS WHOSE SURFACE IS HEATED BY LASER RADIATION
V. A. Dlugunovich, V. A. Zhdanovskii, and V. N. Snopko 1975 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (USSR), v. 23, no. 6, 1975 p 969-974
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The results of measuring reflection from dielectric materials under laser heating show that materials whose thermal expansion occurs by means of the formation of gaseous products without

a change in basic chemical composition do not change their reflection coefficients. Among such materials are organic glass, ebonite, vinyl plastic, polyfluorethylene resin and silicate glass. The formation of deep caverns during burnthrough results in effective absorption increase because of the multiplicity of the reflection from cavern walls. Physicochemical transformations of getinax and textolite under surface heating significantly change their reflection coefficients, governed by the degree of surface heating. Dissert. Abstr.

N76-19423# Perkin-Elmer Corp., Norwalk, Conn.
LASER FUSION SYSTEMS DESIGN STUDY Final Technical Report
Jun. 1975 314 p refs Prepared in Cooperation with Calif. Univ., Livermore. Lawrence Livermore Lab. Sponsored by ERDA
(UCRL-13640) Avail: NTIS HC $18.75

This study investigated: (1) the formulation and evaluation of an alignment system to accomplish pointing, focusing, centering and translation for the 20-arm SHIVA laser, (2) the formulation and evaluation of concepts for the correction of static phase distortions introduced by the accumulated optical elements in the laser chains, (3) the formulation and evaluation of concepts for the correction of optical path length differences between the arms of the SHIVA system, and (4) the conceptual design of appropriate control system hardware. NSA

N76-19424# California Univ., Livermore. Lawrence Livermore Lab.
VALKYRIE, A CO2 LASER SYSTEM FOR LASER FUSION EXPERIMENTS
K. R. Manes, W. B. Lindquist, P. A. Renard, H. E. Eddleman, D. L. Smith, S. S. Glaros, T. C. Stewart, and R. A. Haas Jul. 1975 45 p refs Presented at IEEE Opt. Soc. of Am. Conf. on Laser Eng. and Appl., Washington, D. C., 28 May 1975 Sponsored by ERDA
(UCRL-76350; Conf-750520-10) Avail: NTIS HC $5.25

A short-pulse CO2 laser system fabricated from commercially available components for laser fusion experimentation is described. Simulation calculations are sketched, amplifier testing is discussed, overall laser system performance is reported and the requirements for a typical target irradiation experiment are described. Author (NSA)

N76-19425# California Univ., Livermore. Lawrence Livermore Lab.
ACCELERATION OF POLYETHYLENE FOILS BY LASER DRIVEN ABLATION
H. G. Amlstrom, G. A. Burginyon, and R. A. Haas 10 Oct. 1974 20 p Presented at 16th Ann. Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Albuquerque, N. Mex., 28 Oct. 1974 Sponsored by ERDA
(UCRL-75979; Conf-741079-17) Avail: NTIS HC $4.00

The production of thermonuclear energy, by laser driven implosion of spherical DT shells, with achievable laser technology, requires the development of an efficient and stable implosion. Certain aspects of the acceleration of the spherical shells can be studied experimentally by irradiating thin, 5 to 25 mu m, polyethylene foils. The results of foil acceleration experiments performed using a Nd:YAG-Glass laser capable of producing 150 J, 1 nsec pulses are discussed. The dynamics of the accelerated foil, the ion blow off, high energy electron spectrum, X-ray spectrum, the spatial distribution of the X-ray emission, the laser beam focal spot energy distribution, the laser temporal pulse shape and spectrum for reflected and transmitted radiation have all been measured simultaneously. The results of these measurements are compared with detailed numerical simulations. Author (NSA)

N76-19426# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL X-RAY CONVERSION EFFICIENCIES AND SPECTRA OF SINGLE ELEMENT PLANE TARGETS HEATED BY HUNDRED PICOSECOND LIGHT PULSES FROM NEODYMIUM GLASS LASERS
W. H. Grasberger, C. E. Violet, and L. M. Richards Jul. 1975 24 p Presented at the Meeting of the Am. Phys. Soc., Washington D. C., 28 Apr. 1974 Sponsored by ERDA
(UCRL-76491; Conf-750427-5) Avail: NTIS HC $4.25

A non-LTE rate equation computer program was combined with a program which simulates the heating of laser heated targets in plane geometry. The hydrodynamic program calculates the absorption of laser light, the electron and ion temperatures-allowing for electron heat conduction-and the densities for each time-step and feeds these values to the rate equation program. The rate equation program gives to the hydrodynamic program for each time-step a source-sink term for each hot zone above 20 eV, representing the net emission and adsorption of X rays. The calculations presented involved approximately ten hot and ten cool zones. NSA

N76-19427# California Univ., Livermore. Lawrence Livermore Lab.
HIGH POWER UV METAL VAPOR ION LASERS PUMPED BY THERMAL ENERGY CHARGE EXCHANGE
25 Aug. 1975 49 p refs
(Contract W-7405-eng-48)
(UCID-16884) Avail: NTIS HC $5.50

A general class of metal vapor ion lasers pumped by thermal energy charge exchange (TECX) as possible scalable coherent sources for laser isotope separation was examined. The sources had the following potential characteristics: (1) availability of discrete wavelengths spanning the wavelength region between 2000 A less than lambda less than 8000 A, (2) pulsed or CW operation in the multi-kilowatt average power levels, (3) overall device efficiencies approaching one percent, and (4) the engineering of practical laser devices using relatively benign electron beam technology. Author (NSA)

N76-19428# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF GASEOUS MEDIA FOR SEF 3-DIMENSIONAL DISPLAYS Final Report, 22 Jan. - 31 May 1975
R. H. Barnes, C. E. Moeller, J. F. Kircher, and C. M. Verber 31 May 1975 83 p refs
(Contract N00014-73-C-0254; NR Proj. 215-217)
(AD-A015662) Avail: NTIS CSCL 09/5

This report describes recent progress in the development of gasous display media for 3-dimensional display systems based on two-step excitation of fluorescence. Two-step excitation of IC1 has been demonstrated. Two tunable lasers operating at different wavelengths were employed as excitation sources. Fluorescence was generated at wavelengths as long as 5700 A with sufficient intensity to be observed by eye. A mathematical analysis and experimental measurements were performed to determine the display characteristics of IC1. This information was then used to determine the potential display capabilities of IC1 based on currently available lasers. Author (GRA)

N76-19429# United Technologies Research Center, East Hartford, Conn.
OPTICALLY PUMPED LASER Annual Technical Report, 15 Aug. 1974 - 15 Aug. 1975
Robert T. Brown 15 Oct. 1975 48 p refs
(Contract N00014-74-C-0376; ARPA Order 1807)
(AD-A016667; R75-921853-7) Avail: NTIS CSCL 20/5

This report describes experimental and theoretical studies of a new technique for pumping high-pressure electric-discharge lasers. Using a new Corporate-owned pumping laser, several significant results were achieved. A clear demonstration of lasing on the 3371 A second positive transition in an optically-pumped electric discharge in a helium/nitrogen mixture was obtained. The peak uv signal was increased by three orders of magnitude over that obtained previously with the small TEA laser. Secondly, diffuse, high-electron-density, large-volume discharges were obtained in a geometry suitable for the incorporation of an optical cavity. GRA

N76-19430# Northrop Research and Technology Center, Hawthorne, Calif.
PLASMA ELECTRON GUN Final Report, 26 Dec. 1972 - 25 Feb. 1975
Benedict B. OBrien, Jr., D. B. Cohn, and J. E. Thompson 1975 84 p refs
(Contract DAAH01-74-C-0350)
(AD-A016257; NRTC-75-19R) Avail: NTIS CSCL 09/1

A significant degree of control over the electrical energy

deposition in high pressure gas electric discharge laser media can be realized when the source of ionization is separated from the main source of pumping energy. The most effective external source of ionization offering the widest parametric latitude is a beam of high energy electrons. Since creation of the electron beam takes place in an environment far different from that in the laser cavity, an electron transmitting window, usually a thin metal foil, is required to separate these two regions. These foils, represent a common limitation to overall system reliability. The electron source described in this report makes use of a secondary emission from a cold cathode in a low pressure discharge and is capable of high current densities (about 0.5 A/sq cm) for durations on the order of 20 microseconds. The objective of this program was to characterize the plasma diode electron gun in detail and to apply this data to the conceptual design of large area devices. GRA

N76-19431# National Bureau of Standards, Washington, D.C. Physical Chemistry Div.
THERMODYNAMICS OF CHEMICAL LASER AND HIGH TEMPERATURE SPECIES Final Report, 1 Jul. 1974 - 30 Jun. 1975
Charles W. Beckett Oct. 1975 38 p refs Sponsored by AFOSR
(AF Proj. 9750)
(AD-A017626; NBSIR-75-751; AFOSR-75-1538TR) Avail: NTIS CSCL 07/4

This report (covering July 1974 through June 1975) gives summaries (a) for high-speed thermophysical measurements on hafnium, iron, tantalum, and molybdenum and (b) for an interpretation of the Raman Spectra of PF5, AsF5, and VF5. Details of these activities have been or are in the publishing process. In addition, this report includes two articles which are current and have not started the publication process. One is a study on the chemiluminescence of the Pb(g) - 03(g) reaction, and the other is a review of the literature for dissociation energies of diatomic oxides and fluorides relevant to chemical kinetics are indicated. GRA

N76-19432# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ATMOSPHERIC EFFECTS ON 1.06 MICRON LASER-GUIDED WEAPONS M.S. Thesis
Vance A. Hedin Mar. 1975 119 p refs
(AD-A017460; GEO/PH/75-5) Avail: NTIS CSCL 17/5

With the advent of laser-guided weapons into the Air Force inventory, it has become an item of high interest to decision makers at many levels, from the aircrews who must deliver the weapons, to the high planning levels of the Air Staff, to better understand the significant limitations that weather places on these weapons. This thesis presents an easily useable model for predicting maximum lock-on ranges for 1.06 micrometer laser-guided weapons as a function of two significant weather factors: surface meteorological range and rainfall rate. In addition, a number of sample calculations based on the model are presented. GRA

N76-19433# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
PHOTODISSOCIATION DYE LASER Semiannual Technical Report, 1 Apr. - 30 Sep. 1975
Abraham Kasdan Oct. 1975 44 p refs
(Contract N00014-73-C-0048; ARPA Order 1806)
(AD-A017234; Exxon/GRUS.2BEOB.75) Avail: NTIS CSCL 07/5

The photodissociation dye laser (PDL) program is an effort to develop a new class of tunable liquid lasers operating in the visible region of the spectrum. In the PDL scheme, laser action is expected to occur between an excited electronic state and the ground electronic state of radicals produced by the photodissociation of specific classes of molecules in solution. This scheme is expected to result in several significant advantages over conventional dye lasers. GRA

N76-19434# Bell Aerospace Co., Buffalo, N.Y.
CHEMICALLY PUMPED ATOMIC LASER STUDY Final Report, Mar. 1974 - Mar. 1975
Jay A. Blauer, G. D. Hager, G. W. Tregay, and W. C. Soloman Oct. 1975 79 p refs
(Contract F29601-74-C-0063)
(AD-A017330; AFWL-TR-75-121) Avail: NTIS CSCL 07/4

Experimental data are presented relative to attempts to induce population inversions within the energy manifolds of various atomic species by transfer of vibrational energy from selected diatomic molecules. In those cases studied for which HF or DF are the energy precursors, very low levels of excitation of the atomic species present were observed. This does not seem to be the case when H2 is the vibrational energy reservoir. Experiment and current computer modeling efforts are compared and found to be in good agreement in those cases for which kinetic data are available. GRA

N76-19435# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MAGNETOSTATIC SURFACE WAVES ON A CYLINDER Physical Sciences Research Papers
James C. Sethares 17 Jul. 1975 47 p refs
(AF Proj. 5635)
(AD-A017174; AFCRL-TR-75-0380; AFCRL-PSRP-638) Avail: NTIS CSCL 20/3

Rotation rate sensors have important applications in navigation and guidance control systems. An investigation of magnetostatic surface waves (MSSW) in yttrium iron garnet (YIG) films on cylindrical surfaces was undertaken as a first step in fabricating a new type of rotation rate sensor recently proposed at AFCRL. The sensor employs magnetic (or acoustic) waves in a ring laser type configuration. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-19436* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MIXING INSERT FOR FOAM DISPENSING APPARATUS Patent
William G. Simpson, inventor (to NASA) Issued 2 Mar. 1976 4 p Filed 12 Jun. 1974 Supersedes N74-26989 (12 - 16, p 1924)
(NASA-Case-MFS-20607-1; US-Patent-3,941,355; US-Patent-Appl-SN-478800; US-Patent-Class-259-4AC; US-Patent-Class-222-145) Avail: US Patent Office CSCL 13G

A device for mixing foam ingredients is described. The device comprises an arrangement of lands situated about a cylindrical elongated shaft-like member with each land having a slot. The slots of alternate lands are positioned 180 deg from each other so that as the ingredients flow through the mixing chamber they flow from adjacent one side of the housing to the other dividing as such passes around the shaft-like member.
Official Gazette of the U.S. Patent Office

N76-19437* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AUGER ATTACHMENT METHOD FOR INSULATION Patent
William C. Schneider, inventor (to NASA) Issued 10 Feb. 1976 4 p Filed 24 Jul. 1974 Supersedes N74-30916 (12 - 20, p 2439)
(NASA-Case-MSC-12615-1; US-Patent-3,936,927; US-Patent-Appl-SN-491417; US-Patent-Class-29-526; US-Patent-Class-29-432; US-Patent-Class-29-433; US-Patent-Class-52-705; US-Patent-Class-52-758F; US-Patent-Class-244-117A; US-Patent-Class-244-163) Avail: US Patent Office CSCL 13E

An auger device is used to attach rigidized surface insulation to a spacecraft. The auger is preferably screwed into an insulation tile which has been predrilled. The augertile combination is then fastened to the spacecraft using an attachment screw which penetrates the spacecraft skin and which is secured by a blind end fastener. In an alternate method, the auger is incorporated in the insulation tile when the latter is fabricated.
Official Gazette of the U.S. Patent Office

N76-19438 Cornell Univ., Ithaca, N.Y.
FINITE ELEMENT ANALYSIS OF LUBRICATION IN NATURAL JOINTS Ph.D. Thesis
Boaz Efraim Eidelberg 1975 221 p
Avail: Univ. Microfilms Order No. 76-5928

A finite element model of lubrication in natural joints is developed. The joint is first idealized as a poroelastic region acted upon by a fluid film. Based on known finite element methods in elasticity, porous flow, and hydrodynamic lubrication, the governing equations are discretized. Parallel with the exact formulation, coupling relations are discretized too. As a result, a set of nonlinear equations is formed in which displacements and pressures at specified locations are the field unknowns. The solution of these equations for a specified set of boundary conditions is then sought. By constraining the proper variables in the general poroelastic formulation, specializations are made to cases of plane strain, flow in porous media, and hydrodynamic lubrication. Solutions of these cases are then compared to those obtained from exact analyses and as a result effects of finite element grids are obtained. Dissert. Abstr.

N76-19439*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MECHANICAL SEQUENCER Patent Application
Walter T. Appleberry, inventor (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 17 Feb. 1976 29 p
(Contract NAS9-1400)
(NASA-Case-MSC-19536-1; US-Patent-Appl-SN-658450) Avail: NTIS HC $4.00 CSCL 13I

A mechanical sequencer having a rotatable drive shaft is described. The drive shaft has a spline formed. A freely rotatable shaft contains a plurality of rollers, the axis of the freely rotatable shaft having an axis parallel to and offset from the axis of the drive shaft. A drive fitting has an opening, the drive fitting being positioned on the drive shaft spline for rotating the fitting with the shaft. A finger is formed integral with the drive fitting for enabling the fitting to move the rollers and the freely rotatable shaft. A crank structure is positioned in a plane perpendicular to the axis of the drive shaft and the freely rotatable shaft. The crank structure has a drive shaft opening through which the drive shaft passes. NASA

N76-19440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROSTATIC BEARING SUPPORT Patent Application
R. E. Cunningham, inventor (to NASA) Filed 2 Mar. 1976 12 p
(NASA-Case-LEW-11158-1; US-Patent-Appl-SN-663008) Avail: NTIS HC $3.50 CSCL 13I

A hydrostatic bearing support system is provided which comprises a bearing housing having a polygonally configured outer surface which defines at least three symmetrically disposed working faces and a plurality of pressure plates, each of which is disposed relatively opposite a corresponding working face and spaced therefrom to define a gap there between. A hydrostatic support film is created in the gap for supporting the housing in spaced relationship to the pressure plates. NASA

N76-19441*# New Mexico Univ., Albuquerque.
FIRST SYMPOSIUM ON ROLAMITE
Donald D. Eulert, ed. 1969 184 p refs Symp. held at Albuquerque, New Mexico; sponsored in part by Sandia Labs. Sponsored by NASA
(NASA-CR-146503; TAC-RP-74-400) Avail: NTIS for foreign requesters only; domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC $10.00 CSCL 13I

A collection of papers and transcriptions of workshops focused on rolamite and its suitability in various applications, notably instrumentation, electromechanical and fluid devices, materials and metallurgy, and manfacturing process is presented. For individual titles, see N76-19442 through N76-19456.

N76-19442* Sandia Labs., Albuquerque, N.Mex.
ROLAMITE FUNDAMENTALS
John P. Ford *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 9-28 (For availability see N76-19441 10-37)
CSCL 13I

The rolamite suspension system, its history, features, and capabilities are summarized. Data are included on basic constraints of the system, technical applications, system limitations, and design features. E.H.W.

N76-19443* Rolamite Technology, Inc., Albuquerque, N.Mex.
ACCOMPLISHING USEFUL DEVICE FUNCTIONS WITH ROLAMITE
Donald F. Wilkes and Dean Gladow *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 29-36 (For availability see N76-19441 10-37)
CSCL 13I

Characteristics of the rolamite suspension system and its mechanical design technology are discussed. Particular attention was given to the system's low friction properties, its tolerance of imperfections, variations and contaminations, its adaptability to wide range of uses, and ease of manufacture. Author

N76-19444* Sandia Labs., Albuquerque, N.Mex.
THE ROLAMITE: GEOMETRY AND FORCE ANALYSIS
Richard V. Cadman *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 37-51 refs Sponsored by ERDA (For availability see N76-19441 10-37)
CSCL 13I

The rolamite precision roller band mechanism was examined as a function of the loosness of rolamite band tension. The tight geometry and the slightly loose (small deflection) geometry are described by simple equations. Typical digital computer results are presented for the interroller clearance in the very loose (large deflection) geometry. Rolamite may be made to generate forces if the band fleual rigidity is varied, or if it is precurved. An energy method was used to derive a general form of the force equation. Author

N76-19445* Sandia Labs., Albuquerque, N.Mex.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE DYNAMIC RESPONSE OF ROLAMITE
C. Mark Percival and Frederick R. Norwood *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 53-64 refs (For availability see N76-19441 10-37)
CSCL 13I

Lagrange's equation was used to derive an equation of motion for the rolamite mechanism in the ideal tight configuration; the effects of force generation by bands at varying bending stifness, band inertia, and nonconservative forces are considered. An experimental system for investigating the dynamic response of rolamite is described. The effects of friction on the rolamite mechanism are discussed and experimentally determined values of coefficients of friction are presented. Author

N76-19446* Hamilton Precision Metals, Lancaster, Pa.
MATERIAL PROPERTIES AND TOLERANCES IN ROLAMITE BANDS
M. S. Walmer *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 65-78 refs (For availability see N76-19441 10-37)
CSCL 13I

The rolamite band, the most important part of the rolamite geometry, is examined for spring force effectiveness and other important properties. Characteristics of typical band alloys Havar and beryllium copper are presented for various production methods. Also presented are data on production of rolamite bands, and some basic guidelines for rolamite band design. Author

N76-19447* Technar, Inc., Arcadia, Calif.
ROLAMITE DESIGN USING FIGURES OF MERIT
Lon E. Bell *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 79-86 (For availability see N76-19441 10-37)
CSCL 13I

Band material properties are discussed in terms of two figures of merit that allow materials to be ranked by their performance. One ranks materials of equal thickness by ability to wrap around small diameter rollers. The second ranks materials by the maximum force generated for a specified roller size. Results are tabulated for a wide range of materials. The figures of merit are used to compute minimum and maximum sizes for certain classes of rolamites. Author

N76-19448* Sandia Labs., Albuquerque, N.Mex.
BEARINGS AND SUSPENSION

E. N. Leslie *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 93-95 (For availability see N76-19441 10-37)
CSCL 13I

Rolamite application to a wide variety of bearing and suspension designs for instruments and machinery is summarized. Data cover: (1) rotary-to-linear converters for pumps, (2) bandcase attachment and tension, (3) rotary bearings, (4) friction in linear bearings, (5) gage design, (6) odometers, and (7) rolamite mechanism properties. E.H.W.

N76-19449* Rolamite Technology, Inc., Albuquerque, N.Mex.
INSTRUMENTATION
Dean Gladow *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 96-101 (For availability see N76-19441 10-37)
CSCL 13I

The utilization of the rolamite design as: dial indicators, miniature inertial and tape-recorder devices, low pressure transducers, rotary switches, aircraft part instrumentation controls, dimensional gages, and industrial timing and control mechanisms was investigated. Data are also given on rolamite performance as affected by wear, size, acceleration, and band slippage. Author

N76-19450* Sandia Labs., Albuquerque, N.Mex.
ELECTROMECHANICAL DEVICES
F. A. Duimstra *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 102-106 (For availability see N76-19441 10-37)
CSCL 13I

Electromechanical devices utilizing the rolamite device are described. Information is also given on system limitations as a function of material and current carrying capacity. Author

N76-19451* Rolamite Technology, Inc., Albuquerque, N.Mex.
FLUID DEVICES
Reginald Scroop *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 107-111 (For availability see N76-19441 10-37)
CSCL 13I

Rolamite performance as a valve is discussed. Operating characteristics of the valve in the absence of lubricants or at extreme temperatures were considered. Advantages of the valve, including high sealing and low actuating forces, coupled with the absence of moving seals in the case of magnetically actuated valves are given. E.H.W.

N76-19452* Hamilton Watch Co., Lancaster, Pa.
MATERIAL AND METALLURGY
Marlin S. Walmer *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 114-116 (For availability see N76-19441 10-37)
CSCL 13I

Questions concerning material corrosion, band lubrication, proper band attachment, endless band production rolling, and electrodeposits in rolamite devices are answered. Failure modes of rolamite bands in space applications are also considered. E.H.W.

N76-19453* Technar, Inc., Arcadia, Calif.
ELECTRICAL SWITCHING
R. W. Diller *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 117-124 (For availability see N76-19441 10-37)
CSCL 13I

Rolamite switches, particularly contacts and switching combinations are examined. Economics, design principles, and material considerations are covered. E.H.W.

N76-19454* Technar, Inc., Arcadia, Calif.
TRANSDUCERS AND MEASUREMENTS
William P. Gruber *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 125-130 (For availability see N76-19441 10-37)
CSCL 13I

Several measuring instruments-accelerometers, velocimeters, and integrators - using the rolamite system are described. Operational problems of the system and testing procedures are included. E.H.W.

N76-19455* Sandia Labs., Albuquerque, N.Mex.
MANUFACTURING PROCESSES
B. S. Gardiner *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 131-149 (For availability see N76-19441 10-37)
CSCL 13I

The rolamite manufacturing process, particularly band and contract fabrication is described. Parts assembly and roller and case fabrication are included. Inspection and environmental tests of the units are discussed. E.H.W.

N76-19456* Technar, Inc., Arcadia, Calif.
THEORY AND FORCE GENERATION
Lon E. Bell *In* New Mexico Univ. 1st Symp. on Rolamite 1969 p 150-160 (For availability see N76-19441 10-37)
CSCL 13I

Force generation and its source in self contained non-suspension rolamite devices and in suspension type devices are investigated. Special attention was given to force generated by nonparallel guides. Author

N76-19457*# Ball Bros. Research Corp., Boulder, Colo. Aerospace Div.
ANNULAR MOMENTUM CONTROL DEVICE (AMCD). VOLUME 1: LABORATORY MODEL DEVELOPMENT Final Report
[1975] 108 p ref
(Contract NAS1-12529)
(NASA-CR-144917-Vol-1; F76-02-Vol-1) Avail: NTIS HC $5.50 CSCL 13I

The annular momentum control device (AMCD) a thin hoop-like wheel with neither shaft nor spokes is described. The wheel floats in a magnetic field and can be rotated by a segmented motor. Potential advantages of such a wheel are low weight, configuration flexibility, a wheel that stiffens with increased speed, vibration isolation, and increased reliability. The analysis, design, fabrication, and testing is described of the laboratory model of the AMCD. Author

N76-19458*# Ball Bros. Research Corp., Boulder, Colo. Aerospace Div.
ANNULAR MOMENTUM CONTROL DEVICE (AMCD). VOLUME 2: APPLICATION TO A LARGE SPACE TELESCOPE Final Report
[1975] 50 p
(Contract NAS1-12529)
(NASA-CR-144917-Vol-2; F76-02-Vol-2) Avail: NTIS HC $4.00 CSCL 13I

A conceptual design and set of dynamic equations of a gimbaled AMCD adapted to a Large Space Telescope are presented. Such a system could provide maneuver capability and precision pointing by means of one external gimbal, wheel speed control, and small motions of the rim within the magnetic gap. Author

N76-19459*# Sun Oil Co., Marcus Hook, Pa.
INFRARED EMISSION SPECTRA FROM OPERATING ELASTOHYDRODYNAMIC SLIDING CONTACTS
James L. Lauer 8 Mar. 1976 86 p refs
(Contract NAS3-18531)
(NASA-CR-134973) Avail: NTIS HC $5.00 CSCL 11H

Infrared emission spectra from an operating EHD sliding contact were obtained through a diamond window for an aromatic polymer solute present in equal concentration in four different fluids. Three different temperature ranges, three different loads, and three different speeds for every load were examined. Very sensitive Fourier spectrophotometric (Interferometric) techniques were employed. Band Intensities and band intensity ratios found to depend both on the operating parameters and on the fluid. Fluid film and metal surface temperatures were calculated from the spectra and their dependence on the mechanical parameters plotted. The difference between these temperatures could be plotted against shear rate on one curve for all fluids. However, at the same shear rate the difference between bulk fluid temperature and diamond window temperature was much higher for one of the fluids, a traction fluid, than for the others. Author

N76-19460*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATED STUDIES OF WEAR AND FRICTION IN TOTAL HIP PROSTHESIS COMPONENTS WITH VARIOUS BALL SIZES AND SURFACE FINISHES
Max A. Swikert and Robert L. Johnson Washington Mar.

1976 27 p refs
(NASA-TN-D-8174; E-8528) Avail: NTIS HC $4.00 CSCL 06B

Experiments were conducted on a newly designed total hip joint simulator. The apparatus closely simulates the complex motions and loads of the human hip in normal walking. The wear and friction of presently used appliance configurations and materials were determined. A surface treatment of the metal femoral ball specimens was applied to influence wear. The results of the investigation indicate that wear can be reduced by mechanical treatment of metal femoral ball surfaces. A metallographic examination and surface roughness measurements were made. Author

N76-19461*# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
TRANSIENT EFFECT OF LUBRICANT ON ELASTOHYDRODYNAMIC FILM THICKNESS Final Report
K. L. Wang and H. S. Cheng Washington NASA Mar. 1976 51 p refs
(Grant NGR-14-007-084)
(NASA-CR-2669) Avail: NTIS HC $4.50 CSCL 11H

The inlet solution of the elastohydrodynamic lubricated rolling contact problem was obtained by considering lubricants with transient viscosity. The effect of the viscoelastic retardation time of the lubricant on the center film thickness was investigated. The effect of transient viscosity in response to a sudden pressure was found to be insignificant in determining the film thickness in elastohydrodynamic contacts. Author

N76-19462*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNDAMENTALS OF FLUID SEALING
John Zuk Mar. 1976 167 p refs
(NASA-TN-D-8151; E-6910) Avail: NTIS HC $6.75 CSCL 11A

The fundamentals of fluid sealing, including seal operating regimes, are discussed and the general fluid-flow equations for fluid sealing are developed. Seal performance parameters such as leakage and power loss are presented. Included in the discussion are the effects of geometry, surface deformations, rotation, and both laminar and turbulent flows. The concept of pressure balancing is presented, as are differences between liquid and gas sealing. Mechanisms of seal surface separation, fundamental friction and wear concepts applicable to seals, seal materials, and pressure-velocity (PV) criteria are discussed. Author

N76-19463# Nuclear Metals, Inc., West Concord, Mass.
DEVELOPMENT OF HOT ISOSTATIC PRESSING TECHNIQUES FOR PRODUCING HIGH QUALITY BILLET FROM TITANIUM ALLOY POWDER Final Report, 1 Jul. 1973 - 31 Mar. 1975
Gerald Friedman Apr. 1975 98 p refs
(Contract F33615-73-C-5092; AF Proj. 7351)
(AD-A015894; AFML-TR-75-9) Avail: NTIS CSCL 13/8

The purpose of the program was to establish the relationships between consolidation and mechanical working conditions and the structure and mechanical properties of two types of Ti-6Al-6V-2Sn powders. The program required converting Ti-6Al-6V-2Sn ELI bar from a single heat to powder by two different techniques, the hydride-dehydride process and the Rotating Electrode Process. The powders were to be fully characterized, and a portion consolidated by hot isostatic pressing. Billet portions representing each isostatic consolidation condition were to be examined to determine the relationships between powder type and size, consolidation practice, microstructure, and mechanical properties. GRA

N76-19464# Northrop Corp., Hawthorne, Calif. Aircraft Div.
LOW-TEMPERATURE LARGE-AREA BRAZING OF TITANIUM STRUCTURES Final Report, 1 Jul. 1973 - 31 Jan. 1975
R. R. Wells Jun. 1975 127 p refs
(Contract F33615-73-C-5161; AF Proj. 7351)
(AD-A015860; NOR-75-30; AFML-TR-75-50) Avail: NTIS CSCL 13/8

Various brazing filler metals were identified and brazing processes established for producing large-area damage-tolerant laminates of Ti-6Al-4V, Ti-6Al-6V-2Sn, and Ti-3Al-8V-6Cr-4Mo-4Zr (Beta C) for service between 227 K and 422 K (-50F and 300F). Low melting-temperature filler metals were identified to permit the fabrication of laminates in the STA condition. Brazing filler metals were screened based upon their flow temperature and behavior, lap shear strength, bend deflection, and corrosion resistance. The most attractive brazing filler metals were aluminum brazing sheet 22 and alloys from the Al-Cu-Ag system. The brazing sheet was placed between the lamina and the Al-Cu-Ag alloys were placed alongside the lamina and flowed into the joints. GRA

N76-19465# Southwest Research Inst., San Antonio, Tex.
ROLLING FATIGUE TEST RESULTS ON RAO-28-74 AND RAO-29-74 Final Report, 22 May - 1 Dec. 1974
B. B. Baber and P. M. Ku Wright-Patterson AFB, Ohio AFAPL Jun. 1975 33 p refs
(Contract F33615-74-C-0149; AF Proj. 3048)
(AD-A017558; SwRI-RS-621A; AFAPL-TR-75-55) Avail: NTIS CSCL 11/8

Ten SwRI rolling fatigue testers, using a 4-ball test specimen configuration, were employed to evaluate the effect of four different film thickness ratios on the rolling fatigue life of AISI 52100 CEVM steel balls. Two synthetic lubricants (one MIL-L-7808 and one MIL-L-23699) were used in the program at two test temperature conditions, 150F and 300F, thereby providing four different film thickness ratios ranging from 0.0972 to 0.6489. The results show no significant difference, at the 90-% confidence level, in the fatigue life for the CEVM 52100 steel balls using the two synthetic lubricants at constant test temperatures of 150F and 300F. However, when the results are compared on the basis of the film thickness ratio, it is seen that the two lubricants differ significantly in fatigue behavior at the 90% confidence level. This suggests that rolling fatigue life is dependent upon both the film thickness ratio and the lubricant type. GRA

N76-19176* Ball Bros. Research Corp., Boulder, Colo.
AEROSPACE LUBRICATION TECHNOLOGY TRANSFER TO INDUSTRIAL APPLICATIONS
Thomas J. Loran and Bill Perrin *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 45-57 (For availability see N76-19172 10-12)
CSCL 11H

N76-19177* TRW Systems Group, Redondo Beach, Calif.
A STRUT WITH INFINITELY ADJUSTABLE THERMAL EXPANSIVITY AND LENGTH
Paul T. Nelson *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 59-67 (For availability see N76-19172 10-12)
CSCL 20K

N76-19178* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT FRICTION AND WEAR MECHANISM
E. J. Devine and H. E. Evans *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 69-79 refs (For availability see N76-19172 10-12)
CSCL 14B

N76-19179* Fairchild Space and Electronics Co., Germantown, Md.
METAL WITH A MEMORY PROVIDES USEFUL TOOL FOR SKYLAB ASTRONAUTS
G. A. Smith *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 81-97 (For availability see N76-19172 10-12)
CSCL 14B

N76-19184* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRECISION SIX-METER DEPLOYABLE BOOM FOR THE MARINER-VENUS-MERCURY 1973 MAGNETOMETER EXPERIMENT
Harry F. Burdick *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 161-174 refs (For availability see N76-19172 10-12)
CSCL 14B

N76-19186* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW CONCEPT FOR ACTUATING SPACE MECHANISMS
William C. Stange *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 187-197 ref (For availability see N76-19172 10-12) CSCL 14B

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-19466# General American Transportation Corp., Niles, Ill. General American Research Div.
INSPECTION OF NUCLEAR REACTOR WELDING BY ACOUSTIC EMISSION Interim Report
D. W. Prine May 1975 34 p refs
(Contract E(11-1)-2504)
(PB-245725/7; NUREG-75/101) Avail: NTIS HC $4.00 CSCL 13H

Assembly of and consolidation of GARD (General American Research Division) hardware into a field portable acoustic emission monitor system for the purpose of conducting field tests is reported. The conduction of the first of these tests, the calibration tests, in which welds were tape recorded and used to calibrate the field protable acoustic emission monitor is described along with the conduction of the second of the tests, the production tests. In the production tests, the welds are actual production pieces; and the acoustic emission monitor indications are correlated with ASME code requirement radiographs and other nondestructive test as to location, size, and rejectability of defects. GRA

N76-19467# Army Construction Engineering Research Lab., Champaign, Ill.
PAVEMENT INSPECTION REFERENCE MANUAL Final Report
Mahamed Y. Shahin, Michael Darter, and Francine M. Rozanski Sep. 1975 60 p refs
(AD-A017329; CERL-TIP-C-48) Avail: NTIS CSCL 13/2

This report is designed as an aid for the individual performing pavement inspections as part of an overall pavement maintenance and repair system. The types of distress found in asphalt- and concrete-surfaced pavements are presented; severity levels for each distress type are established and illustrated. The severity levels were based on the effect of the distress on maintenance and repair needs and priorities, ride quality, safety, and structural integrity. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-19468 Virginia Polytechnic Inst. and State Univ., Blacksburg.
LINEAR AND NONLINEAR VIBRATIONS OF IRREGULAR STRUCTURAL ELEMENTS Ph.D. Thesis
Donald Wayne Lobitz 1975 148 p
Avail: Univ. Microfilms Order No. 76-5950

A method of solution is proposed to handle the nonlinear vibrations of irregular structural elements. The method combines a perturbation technique, the method of multiple scales, and the finite element method to produce a solution technique which is not hampered by highly complex structural geometries and variations in physical properties. The method is illustrated by its application to main resonant vibrations in geometrically irregular beams and plates, including nonlinearities associated with the midplane stretching. Using linear modes and frequencies obtained through a finite element analysis in conjunction with a modified Galerkin procedure leads to a set of nonlinear ordinary differential equations in time. These equations are solved using the method of multiple scales. An approximate method is proposed for obtaining linear mode shapes and frequencies of nearly annular and circular plates. The method involves the use of the method of strained coordinates in conjunction with a transfer of the boundary conditions. Dissert. Abstr.

N76-19469*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIDE RANGE STRESS INTENSITY FACTOR EXPRESSIONS FOR ASTM E 399 STANDARD FRACTURE TOUGHNESS SPECIMENS
John E. Srawley 1976 5 p refs Proposed for presentation at conf. of Am. Soc. for Testing and Mater., Committee E-24, Orlando, Fla., 22-26 Mar. 1976
(NASA-TM-X-71881; E-8654) Avail: NTIS HC $3.50 CSCL 13M

For each of the two types of specimens, bend and compact, described previously for plane strain fracture toughness of materials, E 399, a polynominal expression is given for calculation of the stress intensity factor, K, from the applied force, P, and the specimen dimensions. It is explicitly stated, however, that these expressions should not be used outside the range of relative crack length, a/W, from 0.45 to 0.55. While this range is sufficient for the purpose of E 399, the same specimen types are often used for other purposes over a much wider range of a/W; for example, in the study of fatigue crack growth. Expressions are presented which are at least as accurate as those in E 399-74, and which cover much wider ranges of a/W: for the three-point bend specimen from 0 to 1; and for the compact specimen from 0.2 to 1. The range has to be restricted for the compact specimen because of the proximity of the loading pin holes to the crackline, which causes the stress intensity factor to be sensitive to small variations in dimensions when a/W is small. This is a penalty inherently associated with the compactness of the specimen. Author

N76-19470# National Aerospace Lab., Tokyo (Japan).
EXPERIMENTAL INVESTIGATION OF THE FATIGUE STRENGTH OF BONDED LAP JOINTS UNDER FLUCTUATING TENSION. SINGLE LAP JOINTS OF THIN SHEETS
Tameharu Ikeda and Yoshiaki Fujisawa Oct. 1975 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-432) Avail: NTIS HC $3.50

Fatigue tests under fluctuating tention (R=0.1) were carried out on AF-126-2 adhesive bonded single lap joints of 2024C-T3 A1-clad thin sheets to determine the effect of the sheet thickness, the lap length, and the distance from the lap end to the grip end at room temperature. A specimen group was also tested at low temperature (-55 C) to determine the effect of the environmental temperature. The experimental results are summarized as follows: (1) increasing the distance from the lap end to the grip end resulted in a slight increase of the fatigue strength and the static strength, and a decrease of the scatter for endurance (N) of the specimens, and increases of the distance over a certain value had no effect on the (S-N) curve and the static strength. (2) at low temperature, the endurance (N) under higher fluctuating tension load was shorter than the (N) at room temperature, however the reverse tendency was obtained under lower fluctuating tension load. Author

N76-19471# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIALISTS MEETING ON IMPACT DAMAGE TOLERANCE OF STRUCTURES
Jan. 1976 202 p refs In ENGLISH and FRENCH Paper presented at 41st Meeting of the Struct. and Mater. Panel, Ankara, 28 Sep. - 3 Oct. 1975
(AGARD-CP-186; ISBN-92-835-0154-3) Avail: NTIS HC $7.75

Among the subjects covered in this exploratory conference were: blast effects; the type of damage produced by different projectiles; the failure characteristics of the structure under load and its residual strength and life after damage; the relationship between spread of damage, materials used, and detail design features; the degree of projectile penetration and the related

hydraulic ram effect in fuel tanks; and distribution of size, velocity and direction of engine debris fragments and their effect on structure. The relationship to improved aircraft damage tolerance of such factors as: the use of armor and deflectors; the employment of modified engine design (to cause blade failure to be more likely than disc failure and to contain a large portion of the resultant debris); the effectiveness of analysis of damaged structures; and the utilization of methods of improvement of overall aircraft layout are also considered. For individual titles, see N76-19472 through N76-19482.

N76-19472 Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.

STRUCTURAL INTEGRITY REQUIREMENTS FOR PROJECTILE IMPACT DAMAGE; AN OVERVIEW

J. G. Avery, T. R. Porter, and R. W. Lauzze (AFFDL) *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 30 p refs (For availability see N76-19471 10-39)

Aircraft can be exposed to projectile impacts from several sources, including military weapons, hailstones, pebbles, and debris from engine failures. In spite of the importance of the projectile damage threat to many types of aircraft, this category of damage is addressed in only a limited degree by existing design guidelines and specifications. There is a growing body of research results becoming available, and attention is being directed toward making this information usable to designers. The only means of doing this is to integrate projectile damage tolerance considerations within the existing structural design process. A design methodology for projectile damage tolerance and some of the research results available for implementing the methodology are summarized. Author

N76-19473 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

STRUCTURAL ANALYSIS OF IMPACT DAMAGE ON WINGS

Juergen Massmann *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 27 p refs (For availability see N76-19471 10-39)

A recently-developed structural strength model is described, and the functions and characteristics of a damage model are examined. A shock wave model and how it analytically determines the dynamic response of a pressurized flat plate is also presented. Test and finite element results are compared with model-predicted results in order to determine model credibility. The pressures resulting from the detonation of ammunition are discussed, and the contributions of each of the pressure components to the entire response are illustrated. Some advantages of an advanced fragment model are mentioned, and the results from such a model are compared with appropriate test data. Applications of the different damage submodels with respect to a honeycomb structure are shown. Author

N76-19474 Naval Weapons Center, China Lake, Calif.

FLUID DYNAMIC ANALYSIS OF HYDRAULIC RAM

Eric A. Lundstrom and Wallace K. Fung *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 10 p refs (For availability see N76-19471 10-39)

A model was developed for predicting fluid pressure fields generated by tumbling military ammunition. Derivation of the model is described, and comparison with experimental data is shown. Agreement of the model was quite good with shots fired into a test cell with 0-degree obliquity. Significant deviation of the model from experiment was obtained with 30- and 45-degree obliquity shots. Author

N76-19475 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

STUDY OF CERTAIN IMPACT PROBLEMS ON AIRCRAFT STRUCTURES [CALCUL DE QUELQUES PROBLEMES D'IMPACT SUR DES STRUCTURES AERONAUTIQUES]

C. Petiau *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 14 p In FRENCH (For availability see N76-19471 10-39)

After reviewing some of the finite elements, methods used for calculating impacts and transitory responses, the possibilities of application in the following cases are examined: (1) response of structure upon impact of a projectile on an armor-plate; (2) response of structures to forces due to explosion blast; and (3) calculation of hard landings, catapulting and taxiing. Practical calculation of the residual strength of locally damaged structures is also considered. Author

N76-19476 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

COMPUTER METHOD FOR AIRCRAFT VULNERABILITY ANALYSIS AND THE INFLUENCE OF STRUCTURAL DAMAGE ON TOTAL VULNERABILITY

Dieter Kardels *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 21 p refs (For availability see N76-19471 10-39)

Methodology consists of two basic computer models, the socalled ammunition and target models. These models are so constructed that the evaluation of ammunition types such as AP, API, HEI with both impact and proximity fuzes, and fragmenting warheads is possible, as is a detailed vulnerability assessment of a particular aircraft. Various submodels interact in order to show the different types of possible outputs. A special emphasis is given to the influence of structural damage and aerodynamic capabilities on total aircraft vulnerability. Some test data and model prediction results are also graphically presented. Author

N76-19477 Ballistic Research Labs., Aberdeen Proving Ground, Md.

DAMAGE TOLERANCE OF SEMIMONOCOQUE AIRCRAFT

Donald F. Haskell *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 12 p ref (For availability see N76-19471 10-39)

The simple theoretical method which was developed may be used to predict deformation, strain, and fracture of aircraft skin subjected to blast attack. Test results and predictions of the theory compare favorably. The method is used to analytically delineate the factors that significantly affect skin damage tolerance. For the conditions studied, these factors, in decreasing order of influence, are: standoff distance, panel width, skin thickness, aspect ratio, skin ultimate strength, rivet spacing, and rivet hole diameter to skin thickness ratio. Test results of two types of semimonocoque helicopter tail booms damaged by bare explosive charges and small-caliber, high-explosive projectiles while under simulated maximum flight load show that both skin and the skin stiffening system are important in the damage tolerance of these structures. Damage tolerance of these structures is proportional to the section modulus of the undamaged section and inversely proportional to the amount of skin removed from the structure by the damaging agent. It is also demonstrated that large increases in damage tolerance can be achieved by increasing longitudinal stiffness. Author

N76-19478 Rolls-Royce, Ltd., Derby (England). Engine Div.

DEFINITION OF ENGINE DEBRIS AND SOME PROPOSALS FOR REDUCING POTENTIAL DAMAGE TO AIRCRAFT STRUCTURE

D. McCarthy *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 10 p (For availability see N76-19471 10-39)

From an analysis of a large sample of past noncontained engine failures in commercial service, parameters were established for any given engine. Protection of sensitive parts of an aircraft beyond that implicit in the aircraft/engine layout could be provided by recently developed deflector systems capable of deflecting high energy fragments in a harmless direction. Author

N76-19479 Societe Nationale Industrielle Aerospatiale, Toulouse (France).

PROBABILITY OF PERFORATION OF AIRCRAFT STRUCTURES BY ENGINE FRAGMENTS [PROBABILITE DE PERFORATION D'UNE STRUCTURE D'AVION PAR DES DEBRIS DE MOTEURS]

Michel Huret *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 12 p In FRENCH (For availability see N76-19471 10-39)

An analytical approach was presented by which the probability of perforation of aircraft structures by engine fragments may be determined, given a specific fragment ejection model provided by engine designers. Simplifying, realistic assumptions were made

to keep the implementation practical. A mathematical model was derived, taking into account the geometry of the situation, the energy of the fragment and that of the target, and the contact relationship between the fragment and the target.
Transl. by Y.J.A.

N76-19480 British Aircraft Corp. (Operating) Ltd., Bristol (England). Commercial Aircraft Div.
STRUCTURAL EFFECTS OF ENGINE BURST NON CONTAINMENT
T. W. Coombe and D. F. Vowles *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 10 p refs (For availability see N76-19471 10-39)

The requirements and the specified acceptable levels of risk are outlined, as applied to a large subsonic transport aircraft. The resultant damage forms are discussed and some test details given to illustrate the problems. Examples of engine fragment damage potentials are given with an empirically based equation relating fragment energy to target resistance for light alloy, titanium, and steel targets. Two types of design solution are discussed as applied to a large subsonic jet transport. Author

N76-19481 Naval Air Propulsion Test Center, Trenton, N.J.
STUDIES OF ENGINE ROTOR FRAGMENT IMPACT ON PROTECTIVE STRUCTURE
G. J. Mangano *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 24 p refs (For availability see N76-19471 10-39)

Data compilations on aircraft gas turbine engine rotor failures that occurred in U.S. commercial aviation in 1973; the results of exploratory and systematic experimentation conducted to provide design guidelines for turbine rotor burst fragment containment; and an overview of the analytical effort directed toward rotor fragment containment are presented. Author

N76-19482 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Corbeil (France).
BEHAVIOR OF ENGINE CASES ASSOCIATED WITH BLADE RUPTURES [TENUE DES CARTERS MOTEURS LORS DES RUPTURES D'AUBES]
J. Thiery *In* AGARD Specialists Meeting on Impact Damage Tolerance of Struc. Jan. 1976 10 p In FRENCH (For availability see N76-19471 10-39)

The way in which a ruptured blade impacts an engine case was analyzed. A simple test bench, which projects bullets at a variable speed on a small target representative, is described. Tests on various materials such as aluminum, titanium, iron, nickel, and cobalt base alloys in wrought or cast form were conducted at room as well as at elevated temperatures. This test is also able to show the influence of the stiffness, thickness, and mass of the target. Author

N76-19483*# Boeing Co., Wichita, Kans.
A STUDY OF FATIGUE CRACK CLOSURE USING ELECTRIC POTENTIAL AND COMPLIANCE TECHNIQUES
C. K. Clarke and G. C. Cassatt 1 Mar. 1976 43 p refs
(Contract NAS1-13881)
(NASA-CR-144932) Avail: NTIS HC $4.00 CSCL 13M

Compared are closure data produced on the same specimen by the crack tip compliance gage and electric potential techniques. Experiments on 7075-T651 aluminum center cracked panels produced equivalent results on closure using the two techniques. The results also indicated that closure is a function of stress ratio, specimen thickness and maximum applied stress intensity. Maximum stress intensity had a strong effect on closure in the range of applied stresses used. This dependence of closure on specimen thickness and maximum stress intensity accounts for many of the discrepencies in closure behavior reported in the literature. Author

N76-19484*# Scientific Translation Service, Santa Barbara, Calif.
WIND PRESSURE ON STEEL PIPE TOWERS (SECOND REPORT)
Yoshio Shichiri Washington NASA Mar. 1976 14 p ref Transl. into ENGLISH from Denki Gakkai Zasshi (Japan), v. 86, Aug. 1966 p 196-201, 1408-1413
(Contract NASw-2483)
(NASA-TT-F-16966) Avail: NTIS HC $3.50 CSCL 13M

Characteristics of wind pressure on steel pipe towers are investigated. Experimental conditions are described. The experimental results show that the roughness of a pipe surface has a great effect. Author

N76-19485# ARE, Inc., Austin, Tex.
STATE-OF-THE-ART IN VARIABILITY OF MATERIAL PROPERTIES FOR AIRPORT PAVEMENT SYSTEMS Final Report, Jul. 1974 - Jan. 1975
Thomas W. Kennedy, W. Ronald Hudson, and B. F. McCullough Aug. 1975 84 p refs Sponsored in part by Army Engr. Waterways Expt. Station
(Contract DOT-FA73WAI-377)
(AD-A018800/3; FAA-RD-75-209) Avail: NTIS HC $5.00 CSCL 01/5

Types and distributions of variability, including how material properties variation can be determined and evaluated are discussed. A summary is given of the variational characteristics of pavement materials properties for those materials which are currently used in pavement design. The materials include portland cement concrete, asphalt concrete, blackbase and asphalt-treated materials, cement-treated materials, lime-treated materials, and untreated subgrade soils. An attempt is made to summarize the variational characteristics which can be expected for each material for as-built service conditions in pavements. Author

N76-19486# Naval Civil Engineering Lab., Port Hueneme, Calif. Civil Engineering Lab.
STATE-OF-THE-ART FOR PREDICTION OF PAVEMENT RESPONSE Final Report, Aug. 1974 - Sep. 1975
John E. Crawford and Michael G. Katona Sep. 1975 81 p refs Sponsored in part by Army
(Contract DOT-FA73WAI-377)
(AD-A018681; FAA-RD-75-183) Avail: NTIS HC $5.00 CSCL 13/2

The finite element idealization as related to principles of pavement analysis are discussed while other techniques and topics are introduced to provide a complete picture. The topics presented are organized to illustrate the similarities and consequences of using various prediction techniques. These topics include: the theoretical basis of the principal techniques, material models, comparison of analytical and measured results, and the selection of a prediction technique. Author

N76-19487# Advisory Group for Aerospace Research and Development, Paris (France).
THE DEVELOPMENT OF FATIGUE/CRACK GROWTH ANALYSIS LOADING SPECTRA
J. E. Holpp (Aeron. Systems Div., Wright-Patterson AFB, Ohio) and M. A. Landy (Aeron. Systems Div., Wright-Patterson AFB, Ohio) Jan. 1976 36 p refs
(AGARD-R-640; ISBN-92-835-1202-2) Avail: NTIS HC $4.00

A description is given of the processes involved in the development of realistic loading spectra for aircraft structures. These processes are presented in the order in which they would normally be implemented, accompanied by an example that is representative of loading spectra developed for fighter aircraft. The example is included for illustrative purposes only. Criteria are suggested that will help the designer choose the most appropriate methods consistent with his situation. Author

N76-19488# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
CIRCULAR INCLUSIONS, RADIAL NOZZLES AND REINFORCED OPENINGS IN SPHERICAL SHELLS Ph.D. Thesis
Prem Prakash and K. P. Rao 1975 243 p refs Sponsored by Ministry of Defence, New Delhi, India
(AE-324S) Avail: NTIS HC $8.00

The stress analysis of circular inclusions, radial nozzles and reinforced curvilinear holes in spherical shells subjected to internal pressure and/or thermal loadings was presented. An exact estimate of the stresses around such discontinuities is important as they give rise to stress concentrations. Reissner's shallow shell equations were used to obtain the stresses in the spherical shell. The stresses and displacements in the shell and the inclusion or nozzle are obtained by superposing the perturbation caused by the discontinuity on the state that exists in the structure

without a discontinuity. The thermal loading problem is solved by converting it into an equivalent static loading problem. The solution for a curvilinear opening is obtained as a first order perturbation over the circular hole solution using conformal mapping technique. A significant reduction in stress concentration can be achieved by providing a reinforcement around the junction in a pressurized spherical shell with a radial nozzle. For individual titles, see N76-19489 through N76-19492.

N76-19489 Indian Inst. of Science, Bangalore.
CIRCULAR INCLUSION IN A SPHERICAL SHELL UNDER INTERNAL PRESSURE
In its Circ. Inclusions, Radial Nozzles and Reinforced Openings in Spherical Shells 1975 p 15-56 (For availability see N76-19488 10-39)

An analysis was presented to solve the problem of a circular elastic inclusion in a pressurized spherical shell using a continuum approach. Computer programs were developed to solve the problems of a (1) rigid circular inclusion free to move with the shell, (2) clamped rigid circular inclusion and (3) circular elastic inclusion with or without a ring at the junction. Numerical results were obtained for a wide range of parameters. It was found that the maximum principal stresses accurring in a spherical shell with a clamped rigid inclusion are always higher than those due to a rigid inclusion free to move with the shell. The maximum principal stresses in the shell and the inclusion depend very much on their elastic moduli for any given value of curvature parameter. The results obtained for the limiting cases of curvature parameters tending to zero agree very well with those for a flat plate. Author

N76-19490 Indian Inst. of Science, Bangalore.
THERMAL STRESSES IN A SPHERICAL SHELL WITH A CIRCULAR DISCONTINUITY
In its Circ. Inclusions, Radial Nozzles and Reinforced Openings in Spherical Shells 1975 p 57-97 (For availability see N76-19488 10-39)

A method was presented for solving the thermal stress problem in a spherical shell with a circular discontinuity which may be in the form of a circular hole, rigid inclusion or an elastic inclusion. The thermal loading consists of a uniform temperature on the inner and outer surfaces but it may vary linearly across the thickness of the shell and the inclusion. This loading is converted into an equivalent static loading and is solved using the solutions obtained previously. It was seen that a clamped rigid circular inclusion results in a more severe stress concentration than a rigid inclusion free to move with the shell. Uniformly heating a spherical shell with a hole or a temperature varying linearly across the thickness of a shell containing a rigid circular inclusion, such that the temperature of the middle surface of the shell remains unaltered, does not cause any stress concentration. Author

N76-19491 Indian Inst. of Science, Bangalore.
SPHERICAL SHELL WITH A RADIAL NOZZLE
In its Circ. Inclusions, Radial Nozzles and Reinforced Openings in Spherical Shells 1975 p 98-144 (For availability see N76-19488 10-39)

The problem of a spherical shell with a radial nozzle (cylindrical shell) was solved by considering the cylindrical nozzle as an elastic discontinuity in the spherical shell and by using the solutions obtained previously. Internal pressure as well as thermal loadings are considered. Detailed study of the effects of the various parameters on the stress concentration was made. In the case of pressure loading, the stress concentrations in the shell as well as in the nozzle increase with the shell curvature parameter. If the shell is made more rigid than the nozzle, the shell stresses decrease and the nozzle stresses increase and vice versa. Stresses predicted by the present analysis agree well with those obtained by using Esslinger's assumptions. Studies made on the shell nozzle junction with a reinforcement indicate that a symmetric reinforcement is superior to an outside reinforcement and that the choice of an optimum reinforcement needs a careful selection. Author

N76-19492 Indian Inst. of Science, Bangalore.
REINFORCED CURVILINEAR HOLES IN SPHERICAL SHELLS
In its Circ. Inclusions, Radial Nozzles and Reinforced Openings in Sperical Shells 1975 p 145-183 (For availability see N76-19488 10-39)

Stress concentrations were investigated around reinforced curvilinear holes in thin shallow spherical shells under internal pressure using a perturbation technique. The approach involves a first order approximation over the circular hole solution. The analysis is most general insofar as the hole shape is concerned and is applicable to any arbitrary shaped curvilinear hole as long as a suitable conformal transformation function can be obtained from the given contour to a circle. This was illustrated with the problem of elliptical holes and square holes with rounded corners. It was seen that a significant reduction in stress concentration can be achieved by suitably reinforcing the cutout. The contribution of the bending stresses to the stress concentration is quite significant in the case of elliptical and square holes. It was found that the stress concentration for an eccentrically reinforced hole is, in general, higher than that for a symmetrically reinforced hole. Author

N76-19493# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. PART 5A: NONRADIAL NOZZLE AT 22-1/2 DEGREES 2.625 IN OD 2.500 IN. ID, ZERO PENETRATION
R. L. Maxwell and R. W. Holland Mar. 1975 175 p refs
(Contract W-7405-eng-26)
(ORNL-Sub-2203-1-Pt-5A) Avail: NTIS HC $11.75

A continuing series of investigations were conducted to determine experimentally the stress patterns for the junction region of spherical shells with radially and nonradially attached nozzles when subjected to internal pressure and various types of loadings on the nozzles. Results of the investigations conducted on a nonradially attached nozzle of 2.625 in.-OD, 2.500 in.-ID and finished flush with the inner surface of the hemisphere are reported. The nozzle is inclined at 22 1/2 deg from a radial axis. Stress values were determined for the following types of loading: internal pressure applied to the hemisphere and nozzle assembly, an axial load applied collinear with nozzle, and a pure torque applied in the radial plane of the nozzle. NSA

N76-19494# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. PART 5B: NONRADIAL NOZZLE AT 22-1/2 DEGREES 2.625 IN. OD 2.500 IN. ID, ZERO PENETRATION
R. L. Maxwell and R. W. Holland Jun. 1975 179 p
(Contract W-7405-eng-26)
(ORNL-Sub-2203-2-Pt-5B) Avail: NTIS HC $12.00

A continuing series of investigations were conducted to determine experimentally the stress for the junction region of spherical shells with radially and nonradially attached nozzles when subjected to internal pressure and various types of loadings on the nozzles. Results of the investigations conducted on a nonradially attached nozzle of 2.625 in.-OD, 2.500 in.-ID and finished flush with the inner surface of the hemisphere are reported. The nozzle is inclined at 22 1/2 deg from a radial axis. Stress values were determined for the loading of a pure bending moment or axial couple applied in various axial planes of the nozzle.NSA

N76-19495# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. PART 5C: NONRADIAL NOZZLE AT 22-1/2 DEGREES 2.625 IN. OD 2.500 IN. ID, ZERO PENETRATION
R. L. Maxwell and R. W. Holland Jun. 1975 195 p
(Contract W-7405-eng-26)
(ORNL-Sub-2203-3-Pt-5C) Avail: NTIS HC $12.75

A continuing series of investigations were conducted to determine experimentally the stress patterns for the junction region of spherical shells with radially and nonradially attached nozzles when subjected to internal pressure and various types of loadings

on the nozzles. Results of the investigations conducted on a nonradially attached nozzle of 2.625 in.-OD, 2.500 in. ID, and finished flush with the inner surface of the hemisphere are reported. The nozzle was inclined at 22 1/2 deg from a radial axis. Stress values for the following types of loadings are tabulated: internal pressure applied to the hemisphere and nozzle assembly; an axial load applied collinear with nozzle, a pure torque applied in the radial plane of the nozzle, and a pure bending moment or axial couple applied in various axial planes of the nozzle. Various stress vs. profile curves are presented. These curves present the tabulated stress data in graphical format. NSA

N76-19496# Brookhaven National Lab., Upton, N.Y.
ELASTIC AND INELASTIC METHODS OF PIPING SYSTEMS ANALYSIS, A PRELIMINARY REVIEW
M. Reich, E. P. Esztergar, J. Spence, J. Boyle, and T. Y. Chang Feb. 1975 71 p refs Sponsored by ERDA
(BNL-19768) Avail: NTIS HC $6.75

A preliminary review of the methods used for elastic and inelastic piping system analysis is presented. The following principle conclusions are reached: techniques for the analysis of complex piping systems operating in the high temperature creep regime should be further developed; accurate analysis of a complete pipework system in creep using the complete shell finite element methods is not feasible at the present, and the reduced shell finite element method still requires excessive computer time and also requires further investigation regarding the compatibility problems associated with the pipe bend element, particularly when applied to cases involving general loading conditions; and with the current size of proposed high temperature systems requiring the evaluation of long term operating life (30 to 40 years), it is important to adopt a simplified analysis method. A design procedure for a simplified analysis method based on currently available techniques applied in a three-stage approach is outlined. Author (NSA)

N76-19497# Westinghouse Electric Corp., Pittsburgh, Pa.
HEAVY SECTION STEEL TECHNOLOGY PROGRAM. TECHNICAL REPORT NO. 38: FRACTURE TOUGHNESS CHARACTERIZATION OF HSST INTERMEDIATE PRESSURE VESSEL MATERIAL
T. R. Mager, S. E. Yanichko, and L. R. Singer Dec. 1974 43 p refs Sponsored by ERDA
(WCAP-8456) Avail: NTIS HC $5.00

Pertinent fracture technology developed to demonstrate the structural reliability of present and contemplated water cooled nuclear reactor pressure vessels is presented. In order to demonstrate the ability to predict failure of large, heavy-walled pressure vessels under service type loading conditions, the fracture toughness properties of the vessel's materials must be characterized. The sampling procedure and test results are presented for vessel material that was used to characterize the fracture toughness of the HSST Intermediate test vessels. The metallurgical condition and heat treatment of the test material was representative of the vessel simulated service test condition. Test specimen locations and orientations were selected as a function of flaw orientations incorporated in the test vessels. The fracture toughness is documented for the materials from each of the eight HSST intermediate pressure vessels tested to date. NSA

N76-19498# Sandia Labs., Albuquerque, N.Mex.
DYNAMIC NONLINEAR ANALYSIS OF SHELLS OF REVOLUTION
W. A. VonRiesemann, J. A. Stricklin (Texas Agricultural and Mechanical Univ.), and W. E. Haisler 1975 16 p refs Presented at the 3d Intern. Conf. on Structural Mech. in Reactor Tech., Lowdon, 1 Sep. 1975 Sponsored by ERDA
(SAND-75-5012; Conf-750908-1) Avail: NTIS HC $4.00

A description is given of calculations employing DYNAPLAS II which uses the displacement method of analysis in which the nonlinearities are treated as pseudo loads on the right-hand side of the equations of motion. The equations are written for each Fourier harmonic used in representing the asymmetric loading components, and although the left-hand side of the equations is uncoupled, the right-hand side is coupled by the nonlinear pseudo loads. The strain displacement equations of Novozhilov are used and the incremental theory of plasticity is used with the von Mises yield condition and associated flow rule. Either isotropic work hardening or the mechanical sublayer model (an assemblage of elastic perfectly plastic layers) may be used. In addition, strain rate effects may be included. Two temporal integration methods are available; either the explicit central difference method or the implicit Houbolt method. Author (NSA)

N76-19499# Combustion Engineering, Inc., Chattanooga, Tenn. Nuclear Components Dept.
TEST REPORT ON EXPERIMENTAL STRESS ANALYSIS OF A 24 INCH DIAMETER TEE
D. R. Henley Jun. 1975 145 p refs Prepared in cooperation with ORNL Sponsored by ERDA
(CENC-1239) Avail: NTIS HC $10.25

The experimental stress analysis and low cycle fatigue test of one 24 in x 24 in x 24 in schedule 10 stainless steel, ANSI B16.9 tee performed by Combustion Engineering, Inc. are described. The tee was instrumented with 230 rectangular strain gage rosettes. Elastic data were obtained for 12 loading conditions consisting of internal pressure and or orthogonal pure moments and orthogonal direct forces applied individually to the free branch and run ends of the tee. One of the run ends of the tee was 'built in' throughout the test. All loads were applied through pipe extensions welded to the tee. The tee was fatigue tested to failure by applying a cyclic in-plane moment to the branch of the tee assembly. A through-the-wall fatigue crack occurred at 2344 cycles. Significant tests results are summarized and compared with design values tabulated in the ASME Boiler and Pressure Vessel Code. Author (NSA)

N76-19500# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
LIMIT LOAD ANALYSIS OF THICK-WALLED CONCRETE STRUCTURES. A FINITE ELEMENT APPROACH TO FRACTURE
J. H. Argyris, G. Faust, and K. J. Willam 1975 53 p refs Sponsored by Bundesmin. fuer Forsch. u. Technol.
(ISD-166) Avail: NTIS HC $4.50

The interaction of constitutive modeling and finite element solution techniques for limit load prediction of concrete structures is illustrated. On the constitutive side, an engineering model of concrete fracture was developed in which the Mohr-Coulomb criterion is augmented by tension cut-off to describe incipient failure. Upon intersection with the stress path the failure surface collapses for brittle behavior according to one of three softening rules, no-tension, no-cohesion, and no-friction. The stress transfer accompanying the energy dissipation during local failure was modelled by several fracture rules which were examined with regard to ultimate load prediction. On the numerical side the effect of finite element idealization was studied first as far as ultimate load convergence is concerned. Subsequently, incremental tangential and initial load techniques were compared together with the effect of step size. Limit load analyses of a thick-walled concrete ring and a lined concrete reactor closure are given with examples of the engineering praxis. Author (ESA)

N76-19501# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
CRACK RESISTANCE OF SOME STRUCTURAL ADHESIVES DETERMINED ON ADHESIVE BONDED TDCB-SPECIMENS
A. Hartman 17 Dec. 1974 104 p refs Sponsored by Neth. Agency for Aerospace Programs (NIVR)
(NLR-TR-75010-U) Avail: NTIS HC $5.50

Crackline loading was applied in tensile mode, forward shear mode and combined mode to adhesive layers being a part of a tapered double cantilever-beam specimen. Data were collected for the unit width crack resistance average, onset and arrest for a number of structural adhesives. The analysis of the results led to conclusions of a more general nature regarding the cracking behavior of adhesively bonded joints. Other conclusions refer to specific adhesive systems. The determination of an improved peel curve may also have an application in coating research. Author (ESA)

N76-19502# Naval Research Lab., Washington, D.C.
A QUALITATIVE APPRAISAL OF THE DOUBLE ASSYMPTO-

TIC APPROXIMATION FOR TRANSIENT ANALYSIS OF SUBMERGED STRUCTURES EXCITED BY WEAK SHOCK WAVES Final Report
H. Huang Sep. 1975 22 p refs
(NRL Proj. F02-05; SF43422503)
(AD-A015941; NRL-MR-3135) Avail: NTIS CSCL 13/13

Using the problem of the transient response of a spherical elastic shell to the excitation of an incident plane step pressure wave as a test problem for the Doubly Asymptotic Approximation (DAA) method, a qualitative appraisal of this method is summarized as follows: (1) The DAA method, by the nature of its scheme is accurate for the prediction of early-time response; (2) If the intrinsic characteristic of the response of the submerged structure as manifested by its step response is of non-oscillatory nature or is dominated by non-oscillatory components, the DAA solution is not only accurate for late-time by design but also valid for intermediate-time responses; (3) If this intrinsic characteristic is of oscillatory nature or is dominated by oscillatory components, the DAA solution has faster oscillations (frequency distortion) and these oscillations are damped out much sooner than the real response. This indicates that the DAA formulation overestimates the fluid resistance to the structural oscillation; (4) The DAA solution underestimates the maximum oscillatory responses if they do not occur at early-time; (5) The DAA method is not useful for the prediction of the intermediate- and late-time oscillatory characteristics of the response, e.g., the structural vibration after the transit of the incident wave front; (6) Since (3) also represents an overstabilizing effect due to the fluid, the results will be doubtful if the DAA method is applied to analyze dynamic stability problems such as dynamic buckling of submerged shells and other nonlinear response problems. GRA

N76-19503# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
LOW FREQUENCY VIBRATIONS OF ELASTIC BARS
R. D. Mindlin Apr. 1975 70 p refs
(Contract N00014-67-A-0108-0027; NR Proj. 064-388)
(AD-A015678; TR-30) Avail: NTIS CSCL 13/13

The method of expansion of three-dimensional displacements in a double power series of the transverse coordinates is employed to find one-dimensional equations applicable to low frequency vibrations of uniform, elastic, isotropic and anisotropic bars. The axial displacements accompanying torsion are chosen specially for each cross-sectional shape of bar--resulting in the correct, or nearly correct, torsional rigidity. Applications are to bars of elliptic, triangular and rectangular sections, illustrating various independent and coupled extensional, flexural and torsional modes of motion. Author (GRA)

N76-19504# Pennsylvania Transportation Inst., University Park.
PAVEMENT PERFORMANCE AND PAVEMENT DISTRESS AS DETERMINANTS OF BASE COURSE STRUCTURAL EQUIVALENCIES, VOLUME 8 Interim Report, Sep. 1971 - Oct. 1974
H. C. Dunn, E. S. Lindow, and T. D. Larson Oct. 1974 133 p refs Sponsored in part by Penna. Dept. of Transportation
(PB-246038/4; PTI-7513-Vol-8) Avail: NTIS HC $6.00 CSCL 13B

The determination of structural layer equivalencies of the four stabilized base courses by the performance approach and the evaluation of the AASHO design method were studied. A promising relationship which was found to exist between pavement thickness and pavement performance is also discussed. GRA

N76-19505# Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
DEVELOPMENT OF DATA-ACQUISITION SYSTEM FOR STRESS HISTORY STUDIES OF HIGHWAY BRIDGES Interim Report, Jul. 1970 - May 1974
Richard K. Taylor and Floyd K. Jacobsen Apr. 1975 48 p
(PB-245632/5; Rept-59) Avail: NTIS HC $4.00 CSCL 13B

Programs initiated for Field testing of highway bridges are described. Specifically, an electronic data acquisition system which can simultaneously record as many as 28 channels of strain data and related information is detailed. A description of the basic system components is given and the function of the system is described. The system provides an accurate analog record of strain data and other related information produced by heavily loaded trucks crossing the test structures. GRA

N76-19191* Lockheed Missiles and Space Co., Sunnyvale, Calif.
LOADCELL SUPPORTS FOR A DYNAMIC FORCE PLATE
C. W. Keller, L. M. Musil, and John L. Hagy (Shriners Hospital for Crippled Children) *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 265-280 refs (For availability see N76-19172 10-12)
CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N76-19506*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
AN EXPERIMENT TO EVALUATE SKYLAB EARTH RESOURCES SENSORS FOR DETECTION OF THE GULF STREAM Final Report
George A. Maul, Principal Investigator, Howard R. Gordon (Miami Univ., Coral Gables), Stephen R. Baig (Nova Univ., Dania), Michael McCaslin, and Roger J. DeVivo 1976 81 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4713-B)
(E76-10193; NASA-CR-147454) Avail: NTIS HC $5.00 CSCL 08J

The author has identified the following significant results. An experiment to evaluate the Skylab earth resources package for observing ocean currents was performed in the Straits of Florida in January 1974. Data from the S190 photographic facility, S191 spectroradiometer and S192 multispectral scanner, were compared with surface observations. The anticyclonic edge of the Gulf Stream could be identified in the Skylab S190A and B photographs, but the cyclonic edge was obscured by clouds. The aircraft photographs were judged not useful for spectral analysis because vignetting caused the blue/green ratios to be dependent on the position in the photograph. The spectral measurement technique could not identify the anticyclonic front, but mass of Florida Bay water which was in the process of flowing into the Straits could be identified and classified. Monte Carlo simulations of the visible spectrum showed that the aerosol concentration could be estimated and a correction technique was devised.

N76-19507*# National Oceanic and Atmospheric Administration, Washington, D.C.
A CLOUD PHYSICS INVESTIGATION UTILIZING SKYLAB DATA Final Report
John Alishouse, Herbert Jacobowitz, and David Wark, Principal Investigators [1975] 39 p refs EREP
(NASA Order T-4715-B)
(E76-10196; NASA-CR-147474) Avail: NTIS HC $4.00 CSCL 04B

The author has identified the following significant results. A number of new scattering calculations for various models were performed. An atmospheric transmittance program to calculate transmittances on a line-by-line basis was developed for the oxygen A band. A copy of the LOWTRAN 2 program was obtained and modified slightly. Thermodynamic results were obtained from snow, cirrus, and coastal stratus to indicate that 1(1.6)/1(2.125)

ratio is probably not a reliable indicator of snow, ice particles, or water droplets.

N76-19508*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A STUDY OF THE UTILIZATION OF EREP DATA FROM THE WABASH RIVER BASIN Final Report, 1 Apr. 1973 - 8 Dec. 1975
L. F. Silva, Principal Investigator 1976 145 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13301)
(E76-10200; NASA-CR-147412) Avail: NTIS HC $6.00 CSCL 08H

The author has identified the following significant results. The study of the multispectral data sets indicate that better land use delineation using machine processing techniques can be obtained with data from multispectral scanners than digitized S190A photographic sensor data. Results of the multiemulsion photographic data set were a little better than the multiband photographic data set. Comparison results of the interim and filtered S191 data indicate that the data were improved some for machine processing techniques. Results of the S191 X-5 detector array studied over a wintertime scene indicate that a good quality far infrared channel can be useful. The S191 spectroradiometer study results indicate that the data from the S191 was usable, and it was possible to estimate the path radiance.

N76-19509*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
COMPUTER-AIDED ANALYSIS OF SKYLAB MULTISPECTRAL SCANNER DATA IN MOUNTAINOUS TERRAIN FOR LAND USE, FORESTRY, WATER RESOURCE, AND GEOLOGIC APPLICATIONS Final Report, 1 Apr. 1973 - 31 Dec. 1975
Roger M. Hoffer, Principal Investigator 12 Dec. 1975 398 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13380)
(E76-10201; NASA-CR-147473; LARS-Inform-Note-121275) Avail: NTIS HC $10.75 CSCL 08F

The author has identified the following significant results. One of the most significant results of this Skylab research involved the geometric correction and overlay of the Skylab multispectral scanner data with the LANDSAT multispectral scanner data, and also with a set of topographic data, including elevation, slope, and aspect. The Skylab S192 multispectral scanner data had distinct differences in noise level of the data in the various wavelength bands. Results of the temporal evaluation of the SL-2 and SL-3 photography were found to be particularly important for proper interpretation of the computer-aided analysis of the SL-2 and SL-3 multispectral scanner data. There was a quality problem involving the ringing effect introduced by digital filtering. The modified clustering technique was found valuable when working with multispectral scanner data involving many wavelength bands and covering large geographic areas. Analysis of the SL-2 scanner data involved classification of major cover types and also forest cover types. Comparison of the results obtained wth Skylab MSS data and LANDSAT MSS data indicated that the improved spectral resolution of the Skylab scanner system enabled a higher classification accuracy to be obtained for forest cover types, although the classification performance for major cover types was not significantly different.

N76-19510*# California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report, 15 Oct. 1975 - 25 Jan. 1976
Robert N. Colwell, Principal Investigator, Sharon Wall, and Dennis Noren 25 Jan. 1976 17 p ref ERTS
(Contract NAS5-20969)
(E76-10202; NASA-CR-146299; SSL-Ser-17-Issue-6) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-19511*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Final Report, Jul. 1973 - Dec. 1975
David L. Tingey and John Potter, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) Dec. 1975 246 p refs EREP
(Contract NAS9-13303)
(E76-10203; NASA-CR-147444; D180-19209-1) Avail: NTIS HC $8.00 CSCL 04A

The author has identified the following significant results. In the S192 data, a peak was apparent in the lower altitudes that was not present in the shorter wavelengths and grew with increasing wavelength beginning with band 7. For ten S192 wavelengths, the relative altitude increment was determined by knowledge of the relative position of the highest point in the scan arc. Using this scheme, results of scaling and inverting data for passes 47 and 61 were put into two models. Each result had three chart representations: (1) limb brightness measurement, (2) attenuation coefficients, and (3) ratio of the aerosol and Rayleigh coefficients to accentuate layers.

N76-19512*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
EVALUATION OF SKYLAB (EREP) DATA FOR FOREST AND RANGELAND SURVEYS Final Report
Robert C. Aldrich, Principal Investigator, Robert W. Dana, Wallace J. Greentree, Edwin H. Roberts, Nancy X. Norick, Thomas H. Waite, Richard E. Francis (Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.), Richard S. Driscoll (Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.), and Frederick P. Weber 1 Dec. 1975 282 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4106-B)
(E76-10204; NASA-CR-147440) Avail: NTIS HC $9.25 CSCL 08F

The author has identified the following significant results. Four widely separated sites (near Augusta, Georgia; Lead, South Dakota; Manitou, Colorado; and Redding, California) were selected as typical sites for forest inventory, forest stress, rangeland inventory, and atmospheric and solar measurements, respectively. Results indicated that Skylab S190B color photography is good for classification of Level 1 forest and nonforest land (90 to 95 percent correct) and could be used as a data base for sampling by small and medium scale photography using regression techniques. The accuracy of Level 2 forest and nonforest classes, however, varied from fair to poor. Results of plant community classification tests indicate that both visual and microdensitometric techniques can separate deciduous, conifirous, and grassland classes to the region level in the Ecoclass hierarchical classification system. There was no consistency in classifying tree categories at the series level by visual photointerpretation. The relationship between ground measurements and large scale photo measurements of foliar cover had a correlation coefficient of greater than 0.75. Some of the relationships, however, were site dependent.

N76-19513*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY USING ERTS-B DATA Progress Report, 1 Dec. 1975 - 29 Feb. 1976
Douglas M. Pirie and David D. Steller, Principal Investigators (ESCA-Tech Corp., Long Beach, Calif.) 17 Mar. 1976 2 p ERTS
(NASA Order S-54062-A)
(E76-10205; NASA-CR-146300) Avail: NTIS HC $3.50 CSCL 08J

There are no author-identified significant results in this report.

N76-19514*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPARISON OF SKYLAB AND LANDSAT IMAGES FOR GEOLOGIC MAPPING IN NORTHERN ARIZONA Final Report

A. F. H. Goetz, Principal Investigator, M. J. Abrams, A. R. Gillespie, B. S. Siegal, D. P. Elston (Geological Survey, Flagstaff, Ariz.), I. Lucchitta (Geological Survey, Flagstaff, Ariz.), S. S. C. Wu (Geological Survey, Flagstaff, Ariz.), A. Sanchez (Geological Survey, Flagstaff, Ariz.), W. D. DiPaola (Geological Survey, Flagstaff, Ariz.), F. J. Schafer (Geological Survey, Flagstaff, Ariz.) et al 27 Feb. 1976 201 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS7-100)
(E76-10206; NASA-CR-147503) Avail: NTIS HC $7.75 CSCL 08G

The author has identified the following significant results. It was found that based on resolution, the Skylab S190A products were superior to LANDSAT images. Based on measurements of shoreline features in Lake Mead S190A images had 1.5 - 3 times greater resolution than LANDSAT. In general, the higher resolution of the Skylab data yielded better discrimination among rock units, but in the case of structural features, lower sun angle LANDSAT images (50 deg) were superior to higher sun angle Skylab images (77 deg). The most valuable advantage of the Skylab over the LANDSAT image products is the capability of producing stereo images. Field spectral reflectance measurements on the Coconino Plateau were made in an effort to determine the best spectral band for discrimination of the six geologic units in question, and these bands were 1.3, 1.2, 1.0, and 0.5 microns. The EREP multispectral scanner yielded data with a low signal to noise ratio which limited its usefulness for image enhancement work. Sites that were studied in Arizona were Shivwits Plateau, Verde Valley, Coconino Plateau, and Red Lake. Thematic maps produced by the three classification algorithms analyzed were not as accurate as the maps produced by photointerpretation of composites of enhanced images.

N76-19515*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Report
Torgny E. Vinje, Principal Investigator Feb. 1976 10 p refs Sponsored by NASA and Royal Norwegian Council for Sci. and Indust. Res. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10212; NASA-CR-146342; QR-2) Avail: NTIS HC $3.50 CSCL 08L

The author has identified the following significant results. Data showed unexpected great variations in the drift velocity of the ice in the Fram Strait. Land map improvements were achieved by LANDSAT in the eastern part of the Svalbard archipelago.

N76-19516*# Stockholm Univ. (Sweden).
THE BALTIC SEA
Bengt-Owe Jansson and Bo G. Nygvist, Principal Investigators 25 Feb. 1976 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10213; NASA-CR-146343; Rept-2) Avail: NTIS HC $3.50 CSCL 08A

There are no author-identified signi cant results in this report.

N76-19517*# Geological Survey, Reston, Va.
ANALYSIS OF SKYLAB IMAGERY FOR APPLICATION TO THEMATIC MAPPING Final Report
Doyle G. Smith, Principal Investigator Jan. 1976 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4649-B)
(E76-10214; NASA-CR-147443) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-19518*# Bechtold Satellite Technology Corp., City of Industry, Calif.
AN EVALUATION OF SKYLAB (EREP) REMOTE SENSING TECHNIQUES APPLIED TO INVESTIGATIONS OF CRUSTAL STRUCTURE Final Report
Ira C. Bechtold, Principal Investigator, J. T. Reynolds, R. L. Archer, and C. G. Wagner Dec. 1975 306 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14235)
(E76-10215; NASA-CR-147458; BESTEC-101-F-12/75) Avail: NTIS HC $9.75 CSCL 08G

The author has identified the following significant results. Film positives (70mm) from all six S190A multispectral photographic camera stations for any one scene can be registered and analyzed in a color additive viewer. Using a multispectral viewer, S190A and B films can be projected directly onto published geologic and topographic maps at scales as large as 1:62,500 and 1:24,000 without significant loss of detail. S190A films and prints permit the detection of faults, fractures, and other linear features not visible in any other space imagery. S192 MSS imagery can be useful for rock-type discrimination studies and delineation of linear patterns and arcuate anomalies. Anomalous color relectances and arcuate color patterns revealed mineralized zones, copper deposits, vegetation, and volcanic rocks in various locations such as Panamint Range (CA), Greenwater (Death Valley), Lava Mountains (CA), northwestern Arizona, and Coso Hot Springs (CA).

N76-19519*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF SKYLAB EREP DATA FOR LAND USE MANAGEMENT Final Report
David S. Simonett, Principal Investigator Jan. 1976 306 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13314)
(E76-10216; NASA-CR-147457; G-093) Avail: NTIS HC $9.75 CSCL 08B

The author has identified the following significant results. The 1.09-1.19 micron band proved to be very valuable for discriminating a variety of land use categories, including agriculture, forest, and urban classes. The 1.55-1.75 micron band proved very useful in combination with the 1.09-1.19 micron band. Misregistration between spectral bands, even by as little as 1/2 pixel, may degrade classification accuracy. Identification accuracy of boundary or border pixels was as much as 13% lower than the accuracy for identifying internal field pixels. The principal conclusion with respect to the S190B camera system is that the higher resolution of the S190B system in comparison to previous space photography (Gemini, Apollo), to the S190A system (Skylab), and to LANDSAT imagery significantly increases the range of additional discrimination achievable.

N76-19520*# JRB Associates, Ann Arbor, Mich.
USE OF SKYLAB EREP DATA IN A SEA-SURFACE TEMPERATURE EXPERIMENT Final Report, 17 Feb. 1973 - 1 Aug. 1975
David C. Anding, Principal Investigator and John P. Walker Jul. 1975 54 p refs EREP
(Contract NAS9-13277)
(E76-10217; NASA-CR-144479; JRB-75-202-AA) Avail: NTIS HC $4.50 CSCL 08J

The author has identified the following significant results. A sea surface temperature experiment was studied, demonstrating the feasibility of a procedure for the remote measurement of sea surface temperature which inherently corrects for the effect of the intervening atmosphere without recourse to climatological data. The procedure was applied to Skylab EREP S191 spectrometer data, and it is demonstrated that atmospheric effects on the observed brightness temperature can be reduced to less than 1.0 K.

N76-19521*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report
Saul Cooper, Principal Investigator 1 Dec. 1975 7 p Sponsored by NASA ERTS
(E76-10218; NASA-CR-146320; PR-3) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The local user terminal has proven the hypothesis that a relatively inexpensive, automatic, and easily maintained ground receive station for satellite relayed data is practical for operational use. Data acquisition activities were expanded to include both the teletype-relayed information as well as that received directly from local user terminals.

N76-19522*# Federal Geological Survey, Hanover (West Germany).
HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA Final Report
Dieter Bannert, H. Bender, W. Kantor, and W. Kruck, Principal Investigators May 1975 19 p refs Sponsored by NASA and Bundesanstalt fuer Geowissenschaften und Rohstoffe, West Germany Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10219; NASA-CR-144488) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Satellite imagery in combination with ground investigations allows the identification and delineation of the near surface ground water (depth to ground water, salinity). The degree of precision achieved is greater than that obtainable by conventional ground survey methods alone.

N76-19523*# Delaware Univ., Newark. Coll. of Marine Studies.
SPECTRAL REFLECTANCE SIGNATURES OF COASTAL POLLUTANTS
V. Klemas, Principal Investigator, W. Philpot, and G. Davis 19 Jan. 1976 2 p ERTS
(Grant NsG-1149)
(E76-10220; NASA-CR-146321) Avail: NTIS HC $3.50 CSCL 13B

The author has identified the following significant results. Remote sensing from satellites and aircraft was combined with ground truth collected from ships in an attempt to classify coastal and estuarine water types by their spectral reflectance signatures. During ocean waste disposal operations 40 miles off the Delaware coast, water samples were collected and spectroradiometric measurements conducted in the field to provide ground truth for aircraft and LANDSAT overpasses with multispectral scanners.

N76-19524*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Oct. - Dec. 1975
R. A. Halliday, Principal Investigator and I. A. Reid Jul. 1976 10 p refs Sponsored by NASA and Canada Centre for Remote Sensing ERTS
(E76-10221; NASA-CR-146322) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The implementation of the Alaska receive site in December had a significant impact on the Canadian experiment as the number of transmissions now received from some northern sites has increased substantially. Data are now received on as many as 11 orbits each day.

N76-19525*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCES ASSESSMENT AND MONITORING Final Report
K. J. Savastano, Principal Investigator Oct. 1975 92 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-8217-B)
(E76-10222; NASA-CR-147507; MARMAP-105) Avail: NTIS HC $5.00 CSCL 08A

The author has identified the following significant results. The distribution and abundance of white marlin correlated with the chlorophyll, water temperature, and Secchi depth sea truth measurements. Results of correlation analyses for dolphin were inconclusive. Predicition models for white marlin were developed using stepwise multiple regression and discriminant function analysis techniques which demonstrated a potential for increasing the probability of game fishing success. The S190A and B imagery was density sliced/color enhanced with white marlin location superimposed on the image, but no density/white marlin relationship could be established.

N76-19526*# Delaware Univ., Newark. Coll. of Marine Studies.
THE INFLUENCE OF COASTAL FRONTS ON THE MOVEMENT AND DISPERSION OF OIL SLICKS
V. Klemas, Principal Investigator, G. Davis, and S. Kupferman 16 Jan. 1976 2 p ERTS
(Contract NAS5-20983)
(E76-10223; NASA-CR-146334) Avail: NTIS HC $3.50 CSCL 13B

The author has identified the following significant results. LANDSAT, aircraft, and boats were used successfully to study estuarine and coastal fronts or boundaries. Horizontal salinity gradients of 4% in one meter and convergence velocities of the order of 0.1 m/sec were observed. Visibility improved from one meter to two meters as certain boundaries were crossed. Fronts near the mouth of the bay are associated with the tidal exchange with shelf water. By capturing and holding oil slicks, these frontal systems also significantly influence the movement and dispersion of oil slicks in Delaware Bay. Recent oil slick tracking experiments conducted to verify a predictive oil dispersion and movement model have shown that during certain parts of the tidal cycle the oil slicks tend to line up along boundaries.

N76-19527*# Delaware Univ., Newark. Coll. of Marine Studies.
COASTAL ZONE CLASSIFICATION FROM SATELLITE IMAGERY
V. Klemas, Principal Investigator, D. Bartlett, R. Rogers (Bendix Aerospace Systems Corp.), and L. Reed (Bendix Aerospace Systems Corp.) 6 Jan. 1976 2 p ERTS
(Contract NAS5-20983)
(E76-10224; NASA-CR-146335) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. Studies of cover distribution along Delaware's coast, especially in tidal wetlands, were made, utilizing semi-automated analysis of LANDSAT-1 MSS digital data. Cover maps with eleven vegetation and other cover categories were produced with accuracy of identification above 80% in all categories. Recent studies have tested a new technique for training automated analysis which uses ground measured reflectance and atmospheric correction techniques to derive signatures for specific categories in preference to the relative radiance signatures derived from training sets within LANDSAT data itself. Initial tests using a four category scheme indicate that training data based on absolute measured reflectance and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more conventional relative radiance training. The analysis of the same four categories produced average categorization accuracies of 82.1% by conventional reflative radiance training and 81.9% by use of absolute reflectance signatures.

N76-19528*# Delaware Univ., Newark. Coll. of Marine Studies.
VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL
V. Klemas, Principal Investigator, G. Davis, and H. Wang 14 Jan. 1976 2 p ERTS
(Contract NAS5-20983)
(E76-10225; NASA-CR-146336) Avail: NTIS HC $3.50 CSCL 13B

The author has identified the following significant results. LANDSAT, aircraft, ships, and air-dropped current drogues were deployed to determine current circulation and to track oil slick movement on four different dates in Delaware Bay. The results were used to verify a predictive model for oil slicks given their size, location, tidal stage (current), weather (wind), and nature of crude. Both LANDSAT satellites provided valuable data on gross circulation patterns and convergent coastal fronts which by capturing oil slicks significantly influence their movement and dispersion.

N76-19529*# Kanner (Leo) Associates, Redwood City, Calif.
SPACE PHOTOGRAPHY AND GEOLOGICAL STUDIES
G. B. Gonin, ed., S. I. Strelnikov, ed., N. A. Yakovlev, E. M. Grishchuk, N. B. Davidson, A. V. Dolivodobrovolskiy, N. V. Kobets, V. V. Koltsov, V. P. Koroleva, N. V. Kravchuk et al Washington NASA Feb. 1976 523 p refs Transl. into ENGLISH of the book "Kosmicheskaya fotosyemka i Geologicheskiye Issledovaniya" Leningrad, Nedra Press, 1975 p 1-416
(Contract NASw-2790)
(NASA-TT-F-16852) Avail: NTIS HC $12.75 CSCL 08G

Theoretical and practical problems of space photogrammetry and geological interpretation of space photographs are considered. Obtaining images of the sunlit surface of earth from spacecraft is examined, involving spacecraft orientation and laws of displacement deriving from celestial mechanics. Stress is placed on the effect of the atmosphere on the quality of imagery. Results of satellite-track experiments involving the simultaneous photographing of several areas of the earth from space and from aircraft are presented, along with data on aircraft measurements of optical characteristics of certain landscape objects through significant atmospheric thickness. Space photogrammetry is represented by a technique for the rigorous solution of inverse photogrammetric intersection of space photographs, analysis of their measuring properties, transmission of space photographs, and compilation of photomaps in a given projection from space photographs. Also treated is stereophotogrammetry of space photographs. Author

N76-19530*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
SOME PROBLEMS CONCERNED WITH THE GEODETIC USE OF HIGH PRECISION ALTIMETER DATA
D. Leigemann Jan. 1976 67 p refs
(Grant NGR-36-008-161; OSURF Proj. 3210)
(NASA-CR-146302; Rept-237) Avail: NTIS HC $4.50 CSCL 08E

The definition of the geoid in view of different height systems is discussed. A definition is suggested which makes it possible to take into account the influence of the unknown corrections to the various height systems on the solution of Stokes' problem. A solution to Stokes' problem with an accuracy of 10 cm is derived which allows the inclusion of the results of satellite geodesy. In addition equations are developed for the determination of spherical harmonies using altimeter measurements. The influence of the ellipticity of the reference surface is considered. Author

N76-19531*# Ohio State Univ. Research Foundation, Columbus.
ON DIFFERENTIAL TRANSFORMATIONS BETWEEN CARTESIAN AND CURVILINEAR (GEODETIC) COORDINATES
Thomas Soler Jan. 1976 87 p refs
(Grant NGR-36-008-204; OSURF Proj. 3820-A1)
(NASA-CR-146533; Rept-236) Avail: NTIS HC $5.00 CSCL 08E

Differential transformations are developed between Cartesian and curvilinear orthogonal coordinates. Only matrix algebra is used for the presentation of the basic concepts. After defining the reference systems used the rotation (R), metric (H), and Jacobian (J) matrices of the transformations between cartesian and curvilinear coordinate systems are introduced. A value of R as a function of H and J is presented. Likewise an analytical expression for J(-1) as a function of H(-2) and R is obtained. Emphasis is placed on showing that differential equations are equivalent to conventional similarity transformations. Scaling methods are discussed along with ellipsoidal coordinates. Differential transformations between elipsoidal and geodetic coordinates are established. Author

N76-19532*# Kanner (Leo) Associates, Redwood City, Calif.
USE OF REMOTE SENSORS IN MAPPING THE VEGETATION OF VERACRUZ
M. Soto, A. Comez-Pompa, F. Menendez, G. Arp, M. A. Acosta, and G. Ramos Washington NASA Mar. 1976 9 p Transl. into ENGLISH of "Uso de Sensores Remotos en el Mapa de Vegetacion de Veracruz" (unpublished report) Mexico City, Inst. of Biol., Mexico Univ., 1976 p 1-8 Original contains color illustrations
(Contract NASw-2790)
(NASA-TT-F-16942) Avail: NTIS HC $3.50 CSCL 08F

The vegetation of the State of Veracruz, Mexico, is mapped by means of remote sensor techniques. The images used are those of the ERTS II satellite, and the ground support is provided by field studies already conducted. The purpose is to evaluate remote sensor techniques and to have a good map reflecting both the potential vegetation, as well as the actual vegetation of the area. Author

N76-19533*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-1 FLIGHT EVALUATION REPORT Quarterly Report, 23 Oct. 1974 - 23 Jan. 1975
30 Apr. 1975 115 p
(Contract NAS5-21808)
(NASA-CR-143812; A-5086; QR-10) Avail: NTIS HC $5.50 CSCL 05A

Flight performance analysis for the tenth quarter of operation orbit 11467 to 12745 of LANDSAT 1 are presented. Payload subsystems discussed include: power subsystem; attitude control subsystem; telemetry subsystem; electrical interface subsystem; narrowband tape recorders; wideband telemetry subsystem; return beam vidicon subsystem; multispectral scanner subsystem; and data collection system. J.M.S.

N76-19534*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
SOILS MAPS SUPPLEMENT TO SOIL MOISTURE GROUND TRUTH, LAFAYETTE, INDIANA, SITE ST. CHARLES, MISSOURI, SITE Mission Report, 10 Nov. 1975
E. Bruce Jones and Stephen E. Olt 10 Nov. 1975 14 p refs
(Contract NAS5-22312)
(NASA-CR-144732) Avail: NTIS HC $3.50 CSCL 08B

A compilation of soils information obtained as the result of a library search of data on the Lafayette, Indiana, site and St. Charles, Missouri, site is presented. Soils data for the Lafayette, Indiana, site are shown in Plates 1 and 2; and soils data for the St. Charles, Missouri, site are shown in Plates 3 and 4. Author

N76-19535*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG, 1-31 JANUARY 1976
31 Jan. 1976 146 p
(NASA-TM-X-72992; GSFC/LU-76/001; NTISUB/B/138-76/001) Avail: NTIS HC $6.00 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Section 1 and 2 describe the contents and format for the catalogs and the associated mircofilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N76-19536*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG, 1-31 JANUARY 1976
31 Jan. 1976 153 p
(NASA-TM-X-72991; GSFC/LN-76/001) Avail: NTIS HC $6.75 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Author

N76-19537*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES MISSION PERFORMANCE STUDIES.

VOLUME 1: REQUIREMENTS DEFINITION Final Report
2 Aug. 1974 72 p refs
(Contract NAS9-14117)
(NASA-CR-147410; TRW-25651-6002-TU-01-Vol-1) Avail: NTIS HC $4.50 CSCL 05B

The need for a realistic set of earth resources collection requirements to test and maximize the data gathering capabilities of the EOS remote sensor systems is considered. The collection requirements will be derived from established user requirements. In order to confine and bound the requirements study, some baseline assumptions were established. These are: (1) image acquisition is confined to the contiguous United States, (2) the fundamental data users are select participating federal agencies, (3) the acquired data will be applied to generating information necessary or in support of existing federal agency charters, and (4) the most pressing or desired federal agency earth resources data requirements have been defined, suggested, or implied in current available literature. Author

N76-19538*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES MISSION PERFORMANCE STUDIES. VOLUME 2: SIMULATION RESULTS Final Report, 8 May - 2 Aug. 1974
2 Aug. 1974 69 p 2 Vol.
(Contract NAS9-14117)
(NASA-CR-147411; TRW-25651-6002-TU-00-Vol-2) Avail: NTIS HC $4.50 CSCL 05B

Simulations were made at three month intervals to investigate the EOS mission performance over the four seasons of the year. The basic objectives of the study were: (1) to evaluate the ability of an EOS type system to meet a representative set of specific collection requirements, and (2) to understand the capabilities and limitations of the EOS that influence the system's ability to satisfy certain collection objectives. Although the results were obtained from a consideration of a two sensor EOS system, the analysis can be applied to any remote sensing system having similar optical and operational characteristics. While the category related results are applicable only to the specified requirement configuration, the results relating to general capability and limitations of the sensors can be applied in extrapolating to other U.S. based EOS collection requirements. The TRW general purpose mission simulator and analytic techniques discussed in this report can be applied to a wide range of collection and planning problems of earth orbiting imaging systems. Author

N76-19539*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTILAYERED MODELS FOR ELECTROMAGNETIC REFLECTION AMPLITUDES
William I. Linlor Mar. 1976 55 p refs
(NASA-TR-R-438; A-5862) Avail: NTIS HC $4.50 CSCL 08L

The remote sensing of snowpack characteristics with surface installations or with an airborne system could have important applications in water resource management and flood prediction. To derive some insight into such applications, the electromagnetic response of multilayer snow models is analyzed. Normally incident plane waves are assumed at frequencies ranging from 10 to the 6th power to 10 to the 10th power Hz, and amplitude reflection coefficients are calculated for models having various snow-layer combinations, including ice sheets. Layers are defined by a thickness, permittivity, and conductivity; the electrical parameters are constant or prescribed functions of frequency. To illustrate the effect of various layering combinations, results are given in the form of curves of amplitude reflection coefficients, versus frequency for a variety of models. Under simplifying assumptions, the snow thickness and effective dielectric constant can be estimated from the reflection coefficient variations as a function of frequency. Author

N76-19540*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLICATION OF REMOTELY SENSED MULTISPECTRAL DATA TO AUTOMATED ANALYSIS OF MARSHLAND VEGETATION. INFERENCE TO THE LOCATION OF BREEDING HABITATS OF THE SALT MARSH MOSQUITO (AEDES SOLLICITANS)
William G. Cibula Feb. 1976 36 p refs Original contains color illustrations
(NASA-TN-D-8139; JSC-S-373) Avail: NTIS HC $4.00 CSCL 08F

The techniques used for the automated classification of marshland vegetation and for the color-coded display of remotely acquired data to facilitate the control of mosquito breeding are presented. A multispectral scanner system and its mode of operation are described, and the computer processing techniques are discussed. The procedures for the selection of calibration sites are explained. Three methods for displaying color-coded classification data are presented. Author

N76-19541# DBA Systems, Inc., Melbourne, Fla.
SKYLAB ALTIMETRY DATA REDUCTIONS AND DEVELOPMENT OF PROGRAMS FOR PRE AND POST PROCESSING OF ALTIMETRY DATA FOR SARRA REDUCTIONS Final Report, Nov. 1974 - Jun. 1975
Jerry E. Trotter Jun. 1975 60 p refs
(Contract F19628-75-C-0090; AF Proj. 7600)
(AD-A015813; AFCRL-TR-75-0359) Avail: NTIS CSCL 08/5

The reductions of the skylab altimetry data offered the first opportunity to reduce real data with the SARRA computer program. The results from residual evaluations clearly illustrate the presence of a severe undulation in the vicinity of the Puerto Rico Trench. Pre and post processing programs were developed to supplement the operation of the program SARRA and to assist in the evaluation and presentation of the geoid results obtained from SARRA reductions. GRA

N76-19542# Hughes Research Labs., Malibu, Calif.
PROTOTYPE MOVING BASE ROTATING GRAVITY GRADIOMETER Final Report, 1 Feb. 1972 - 30 Apr. 1975
Charles B. Ames, Robert L. Forward, Philip M. LaHue, Larry R. Miller, and Robert W. Peterson May 1975 168 p refs
(Contract F19628-72-C-0222; ARPA Order 1838)
(AD-A015832; AFCRL-TR-75-0362) Avail: NTIS CSCL 08/5

This report documents the accomplishments of a 39 month contract to develop a prototype Rotating Gravity Gradiometer (RGG) for moving base applications. GRA

N76-19543# Ohio State Univ., Columbus. Dept. of Geodetic Science.
FORMULAS AND FORTRAN PROGRAMS TO DETERMINE ZONAL COEFFICIENTS FROM SATELLITE OBSERVATIONS Interim Report
Klaus-Peter Schwarz (Tech. Hochschule, Graz, Austria) May 1975 43 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-A015768; DGS-222; AFCRL-TR-75-0341; SR-24) Avail: NTIS CSCL 08/5

Following a proposal by Moritz and Schwarz the collocation method is applied to determine zonal coefficients from satellite observations. The perturbation equations are specialized from Kaula's more general formulas and are supplemented by a recurrence relation for the inclination function. The computational formulas for the collocation procedure are summarized and a method is given to determine the optimal number of coefficients by an eigenvalue analysis of the error covariance matrix. Two programs have been developed. The first one computes the coefficients of the perturbation equation, the second one determines the collocation solution and performs the accuracy analysis. GRA

N76-19544# Enviro Control, Inc., Rockville, Md.
STUDY OF FEDERAL WATER QUALITY MONITORING EFFICIENCY Final Report
A. Hershaft 15 Mar. 1975 162 p refs Sponsored by Council on Environ. Quality
(PB-246221/6; EQ-4AC0141) Avail: NTIS HC $6.75 CSCL 13B

A critical review and analysis is presented of federal policies and practices concerning water quality monitoring. The nature and objectives of monitoring, data collection requirements, and processing and dissemination requirements are included. GRA

N76-19545# Midwest Research Inst., Kansas City, Mo.
BASE LINE FORECASTS OR RESOURCE RECOVERY, 1972 TO 1990 Final Report
Gary R. Nuss, William E. Franklin, David Hahlin, William Park,

and Michael Urie Mar. 1975 386 p refs
(Contract EPA-68-01-0793)
(PB-245924/6; EPA/530/SW-107C) Avail: NTIS HC $10.75 CSCL 13B

An assessment is made of the future of resource recovery from municipal waste for the years 1972 to 1990, based on the assumption there would be no federal legislation to stimulate resource recovery to 1990. Key methods of recovery are examined with emphasis on large-scale system recovery techniques (primary energy/material recovery by SMSA). Data on material collection, recycling centers, and current scrap dealers are also included. The results are summarized by material for the resources studied; glass, ferrous metals, aluminum, plastics, rubber, paper. GRA

N76-19546# Brookings Institution, Washington, D.C.
MODELING LARGE SCALE SYSTEMS AT NATIONAL AND REGIONAL LEVELS, REPORT OF A WORKSHOP
Harold Chestnut and Thomas B. Sheridan Feb. 1975 56 p Workshop held at Washington, D. C., 10-12 Feb. 1975
(Grant NSF ENG-75-00738)
(PB-246248/9) Avail: NTIS HC $4.50 CSCL 05A

The report of a 1975 workshop held at the Brookings Institution, Washington, D.C. to review existing national and regional large scale models and to prepare a list of needed model improvements and research tasks for achieving such improvements is presented. The report consists of a summary of the recommendations of the conference participants for additional research in large scale models, a summary of five different models presented at the conference, a summary of the comments by a panel of model users, and a detailed discussion of an agenda for research on large scale modeling. GRA

N76-19547# Tri-State Regional Planning Commission, New York.
THE TRI-STATE COASTAL ZONE MANAGEMENT PERSPECTIVES
Apr. 1975 50 p refs Sponsored in part by Urban Mass Transportation Admin., Washington, D. C. and Dept. of Housing and Urban Develop., Washington, D. C.
(PB-245658/0; TSRPC-2069) Avail: NTIS HC $4.00 CSCL 13B

Tri-State has studied the impact of shipping, power generation, waste disposal and recreation on the coastal area, and urges the Region to accommodate the essential economic, cultural and leisure needs of its people there, and to guard, restore or enhance the natural character of the coastal zone. Although the three states of the Tri-State Region are becoming increasingly involved in wetlands preservation, water and air resources planning and control, and in regulating uses of shore areas, the Commission recommends the establishment of a new management mechanism, which would be guided by the need to combine coastal zone uses with resource continuance and renewal. GRA

N76-19548# National Oceanic and Atmospheric Administration, Rockville, Md.
INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES, IFYGL BULLETIN NO. 15
Aug. 1975 103 p refs
(COM-75-11462/9; IFYGL-Bull-15; NOAA-75092304) Avail: NTIS HC $5.50 CSCL 08H

Data are presented for both the United States and Canada. The contents include: IFYGL bibliography-which contains official IFYGL publications, a bibliography, and additions to the IFYGL bibliography; Canadian project reports; Canadian IFYGL data management report - which contains a list of IFYGL data publications, and abstracts of IFYGL papers; comments by the U.S. director; lake-averaged temperatures and currents in Lake Ontario in 1972; Lake Ontario beginning-of-month levels and changes in storage; U.S. scientific program - which includes tasks, and panel reports; and data management-IFYGL archive. GRA

N76-19712 Wisconsin Univ., Madison. Dept. of Meteorology.
GLACIER RECESSION IN EAST AFRICA
Stefan Hastenrath *In* WMO Long-term Climatic Fluctuations 1975 p 135-142 refs (For availability see N76-19697 10-47) Copyright.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-19549*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SECONDARY AEROSPACE BATTERIES AND BATTERY MATERIALS: A BIBLIOGRAPHY, 1969 - 1974
P. McDermott, G. Halpert, S. Ekpanyaskun, and P. Nche Dec. 1975 138 p refs
(NASA-TM-X-71075; X-711-75-316) Avail: NTIS HC $6.00 CSCL 10C

Literature in the field of secondary batteries covering a period from 1919 to 1974 is surveyed. Topics covered include: electrochemical systems and system components; and techniques and processes used in analytical, thermal, metallurgical, and kinetic studies. An author index, a publication listing of forty journals, and citations and abstracts for the articles in each journal are presented. Author

N76-19550 Massachusetts Univ., Amherst.
DESIGN AND OPTIMIZATION OF THE POWER CYCLE AND THE HEAT EXCHANGERS FOR AN OCEAN THERMAL POWER SYSTEM Ph.D. Thesis
James William Connell, III 1975 295 p
Avail: Univ. Microfilms Order No. 76-5275

A comprehensive digital computer design model for a closed Rankine power cycle utilizing the temperature potential of two ocean currents which provide the heat source and heat sink for the power cycle is presented. A simplified plate-fin heat exchanger surface geometry is proposed for use by both the evaporator and condenser. A detailed numerical design technique is presented for the proposed compact exchanger geometry. The evaporator modeling is one-dimensional and employs the empirical results for predicting local values of the working fluid forced convection evaporating heat transfer coefficient. The condenser modeling is also one-dimensional and employs a combination of analytical and empirical technique for predicting local values of the working fluid forced convection condensing heat transfer coefficient. In addition computational procedures for evaluating local values of the fluid phase volumetric concentrations and two-phase pressure gradient are included in the design technique. Dissert. Abstr.

N76-19551*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL INVESTIGATION OF A 14 FOOT VERTICAL AXIS WINDMILL
R. J. Muraca and R. J. Guillotte Mar. 1976 33 p refs
(NASA-TM-X-72663) Avail: NTIS HC $4.00 CSCL 10A

A full scale wind tunnel investigation was made to determine the performance characteristics of a 14 ft diameter vertical axis windmill. The parameters measured were wind velocity, shaft torque, shaft rotation rate, along with the drag and yawing moment. A velocity survey of the flow field downstream of the windmill was also made. The results of these tests along with some analytically predicted data are presented in the form of generalized data as a function of tip speed ratio. Author

N76-19552*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE FORMULATED PLASTIC SEPARATORS FOR ALKALINE BATTERIES Patent Application
D. W. Scheibley, J. M. Bozek, and D. G. Soltis, inventors (to NASA) Filed 8 Mar. 1976 10 p
(NASA-Case-LEW-12363-1; US-Patent-Appl-SN-665034) Avail: NTIS HC $3.50 CSCL 10C

A flexible separator for alkaline batteries is described which comprises a coating applied to a nonwoven porous substrate such as sheets or mats of asbestos or other materials which

are inert with respect to the alkaline electrolyte of the battery. The coating material comprises a polyphenylene oxide polymer, an organic additive and inorganic and organic fillers which comprise 55% by volume or less of the coating material. Preferably, at least one inorganic filler material which is reactive with the electrolyte is included to produce desirable pores in the coating. The organic additive is a polymeric polyester material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the coating. NASA

N76-19553*# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
ANALYSIS OF UF6 BREEDER REACTOR POWER PLANTS Final Report
J. D. Clement and J. H. Rust 6 Feb. 1976 140 p refs
(Grant NsG-1168)
(NASA-CR-146502) Avail: NTIS HC $6.00 CSCL 10B

Gaseous UF6 fueled breeder reactor design and technical applications of such concepts are summarized. Special attention was given to application in nuclear power plants and to reactor efficiency and safety factors. For individual titles, see N76-19554 through N76-19559.

N76-19554* Georgia Inst. of Tech., Atlanta.
BACKGROUND
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 6-33 refs (For availability see N76-19553 10-44) CSCL 10B

An analysis was made of the UF6 fueled gas core reactor as a function of cavity reactor criticality and fluid mechanics tests, investigations of uranium optical emission spectra, and radiant heat transfer power plant studies. Data are also given on nuclear and thermodynamic cycle analysis. E.H.W.

N76-19555* Georgia Inst. of Tech., Atlanta.
MATERIALS CONSIDERATIONS FOR THE GAS CORE BREEDER REACTOR
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 34-45 refs (For availability see N76-19553 10-44) CSCL 10B

The selection of materials for gas core breeder reactor fuel, blanket, core liner, pressure vessel, system piping, and turbine blades was discussed. System design properties are summarized. Author

N76-19556* Georgia Inst. of Tech., Atlanta.
NUCLEAR ANALYSIS
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 46-72 refs (For availability see N76-19553 10-44) CSCL 10B

The MACH-1 and the THERMOS codes and their use as computational tools in nuclear analysis are examined. One dimensional survey calculations were carried out for a UF fueled core surrounded by a molten blanket; two dimensional calculations were made later with r-z geometry using the EXTERMINATOR program. Results and comparisons of the calculations are given in tabular form. Author

N76-19557* Georgia Inst. of Tech., Atlanta.
THERMODYNAMIC CYCLE ANALYSIS
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 73-78 ref (For availability see N76-19553 10-44) CSCL 10B

An analysis was made of Rankine cycle efficiency in nuclear power plants with and without reheat capabilities. In addition, temperatures and pressures at certain selected locations were carried out to optimize plant efficiency. It was determined that plant efficiency without reheat was 39.03%, with reheat, a maximum efficiency of 4.44% was obtained at a pressure of 435.12 psia. Data also indicate efficiency appears to increase for pressures greater than 720 psia. However, higher pressures cannot be used because calculations indicate these pressure reheat temperatures exceed 1650 R, which is not allowed due to material limitations. Author

N76-19558* Georgia Inst. of Tech., Atlanta.
HEAT TRANSFER AND FLUID FLOW
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 73-78 ref (For availability see N76-19553 10-44) CSCL 10A

Heat transfer and flow characteristics of UF6 flowing in a gas core reactor were analyzed through solution of the energy equation. The thermal-physical properties of UF6 are given. Author

N76-19559* Georgia Inst. of Tech., Atlanta.
MECHANICAL DESIGN
In its Analysis of UF6 Breeder Reactor Power Plants 6 Feb. 1976 p 90-105 refs (For availability see N76-19553 10-44) CSCL 10B

Design concepts for a 1000 mw thermal stationary power plant employing the UF6 fueled gas core breeder reactor are examined. Three design combinations-gaseous UF6 core with a solid matrix blanket, gaseous UF6 core with a liquid blanket, and gaseous UF6 core with a circulating blanket were considered. Results show the gaseous UF6 core with a circulating blanket was best suited to the power plant concept. Author

N76-19560*# RCA Labs., Princeton, N.J.
EPITAXIAL SOLAR CELLS FABRICATION Final Report, 11 Nov. 1974 - 10 Nov. 1975
R. V. DAiello, P. H. Robinson, and H. Kressel Dec. 1975 81 p refs
(Contract NAS3-19401)
(NASA-CR-134968; PRRL-75-CR-73) Avail: NTIS HC $5.00 CSCL 10A

Silicon epitaxy has been studied for the fabrication of solar cell structures, with the intent of optimizing efficiency while maintaining suitability for space applications. SiH2CL2 yielded good quality layers and junctions with reproducible impurity profiles. Diode characteristics and lifetimes in the epitaxial layers were investigated as a function of epitaxial growth conditions and doping profile, as was the effect of substrates and epitaxial post-gettering on lifetime. The pyrolytic decomposition of SiH4 was also used in the epitaxial formation of highly doped junction layers on bulk Si wafers. The effects of junction layer thickness and bulk background doping level on cell performance, in particular, open-circuit voltage, were investigated. The most successful solar cells were fabricated with SiH2 CL2 to grow p/n layers on n(+) substrates. The best performance was obtained from a p(+)/p/n/n(+) structure grown with an exponential grade in the n-base layer. Author

N76-19561*# Southern Research Inst., Birmingham, Ala.
DEVELOPMENT OF ANION-SELECTIVE MEMBRANES
R. E. Lacey and D. R. Cowsar Oct. 1975 52 p refs
(Contract NAS3-18898)
(NASA-CR-134932; SORI-EAS-75-501) Avail: NTIS HC $4.50 CSCL 10A

Methods were studied of preparing anion-exchange membranes that would have low resistance, high selectivity, and physical and chemical stability when used in acidic media in a redox energy storage system. Of the twelve systems selected for study, only the system that was based on crosslinked poly-4-vinylpyridinium chloride produced physically strong membranes when equilibrated in I M HCl. The resistivity of the best membrane was 12 ohm-cm, and the transference number for chloride ions was 0.81. Author

N76-19562# Joint Economic Committee (U. S. Congress).
POTENTIAL HEATING OIL SHORTAGES
Washington GPO 1973 218 p refs Hearings before Subcomm. on Consumer Economics of Joint Economic Comm., 93d Congr., 1st Sess., 18 and 20 Sep. 1973
(GPO-24-027) Avail: SOD HC $1.65

The possibility of heating oil shortages on a national scale is considered. Emphasis is placed on the outlook for distillate fuels, programs concerning priority use of low-sulfur fuels, the propane allocation program, and the operation of the voluntary petroleum allocation program. J.M.S.

N76-19563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TYPE A AND C FLUORINATED ETHYLENE PROPYLENE (FEP) AS COVER MATERIALS FOR SILICON SOLAR CELLS

Jacob D. Broder Mar. 1976 10 p
(NASA-TM-X-3375; E-8597) Avail: NTIS HC $3.50 CSCL 10A

Fluorinated ethylene propylene film (FEP, 0.0127 cm thick) was heat and pressure laminated to silicon solar cells as a low cost substitute for quartz covers. The FEP-C, treated on one side for bonding, was compared to FEP-A, an untreated FEP. With FEP-A, a silane adhesion promoter was applied to the cells. The FEP-C covers delaminated during accelerated temperature-humidity testing and Earth environmental exposure testing; FEP-A covers were unchanged. No differences were observed in peel tests, but FEP-A is superior in its resistance to tearing and in retention of transmission properties after exposure to ultraviolet radiation. Author

N76-19564*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLAR HYDROGEN GENERATOR Patent Application
Daniel I. Sebacher and Alexander P. Sabol, inventors (to NASA) Filed 24 Mar. 1976 11 p
(NASA-Case-LAR-11361-1; US-Patent-Appl-SN-669928) Avail: NTIS HC $3.50 CSCL 10A

An apparatus is disclosed for using solar energy to decompose water molecules into hydrogen and oxygen molecules. Solar energy is concentrated on a globe containing water thereby heating the water to its dissociation temperature. The globe is pervious to hydrogen molecules permitting them to pass through the globe while being essentially impervious to oxygen molecules. The hydrogen molecules are collected after passing through the globe and the oxygen molecules are removed from the globe. NASA

N76-19565# Oak Ridge National Lab., Tenn.
ASSESSMENT OF INDUSTRIAL ENERGY OPTIONS BASED ON COAL AND NUCLEAR SYSTEMS
T. D. Anderson, H. I. Bowers, R. H. Bryan, J. G. Delene, E. C. Hise, J. E. Jones, Jr., O. H. Klepper, S. A. Reed, and I. Spiewak Jul. 1975 330 p refs
(Contract W-7405-eng-26)
(ORNL-4995) Avail: NTIS HC $10.60

Industry consumes about 40 percent of the total primary energy used in the United States. Natural gas and oil, the major industrial fuels, are becoming scarce and expensive; therefore, there is a critical national need to develop alternative sources of industrial energy based on the more plentiful domestic fuels--coal and nuclear. This report gives the results of a comparative assessment of nuclear- and coal-based industrial energy systems which include technical, environmental, economic, and resource aspects of industrial energy supply. The nuclear options examined were large commercial nuclear power plants (light-water reactors or high-temperature gas-cooled reactors) and a small [approximately 300-MW(t)] special-purpose pressurized-water reactor for industrial applications. Coal-based systems selected for study were those that appear capable of meeting environmental standards, especially with respect to sulfur dioxide. Author (NSA)

N76-19566# Federal Energy Administration, Washington, D.C. Office of Energy Conservation and Environment.
FEDERAL ENERGY MANAGEMENT PROGRAM, FISCAL YEAR 1975 Quarterly Report, Jan. - Mar. 1975
Jul. 1975 11 p
(PB-246314/9; FEA/D-75-516; Paper-30; QR-3) Avail: NTIS HC $3.50 CSCL 21D

Energy use by the federal government during the third quarter of the Fiscal Year 1975 (Jan.-Mar. 1975) is analyzed. The total amount of energy saved during the first 9 months of FY 75 is 425.4 trillion Btu, which amounts to a total reduction in use of 25.3 percent, which is about 10 percent more than ordered by the President. Energy use is monitored in the 26 Federal departments and agencies that account for about 99 percent of all the energy expended by the federal government. Use is measured in two broad categories: (1) energy used in buildings and facilities and (2) energy used in operating vehicles and other similar equipment. Data also reflect the types of energy and amounts of each that the government uses. GRA

N76-19567# TRW Systems Group, Redondo Beach, Calif.
OCEAN THERMAL ENERGY CONVERSION RESEARCH ON AN ENGINEERING EVALUATION AND TEST PROGRAM. VOLUME 3: BASELINE SYSTEM CONCEPT
Jun. 1975 195 p Previously announced as SAN-1089-T1-P3
(Contract NSF C-958)
(PB-246180/4; NSF/RA/N-75-080C-Vol-3; SAN-1089-T1-P3) Avail: NTIS HC $7.50; HC also available $27.00/set of 5 reports as PB-246177-SET CSCL 10A

This volume examines the use of a baseline concept, defined here as one which embodies basic system principles with the lowest possible technical risk. System concepts were postulated and ranked with criteria of performance, risk and cost. The baseline system concept used a binary, closed Rankine cycle using ammonia as the working fluid. GRA

N76-19568# TRW Systems Group, Redondo Beach, Calif.
OCEAN THERMAL ENERGY CONVERSION RESEARCH ON AN ENGINEERING EVALUATION AND TEST PROGRAM. VOLUME 4: TEST PROGRAM PLAN
Jun. 1975 51 p Previously announced as SAN-1089-T1-P4
(Contract NSF C-958)
(PB-246181/2; NSF/RA/N-75-080D-Vol-4; SAN-1089-T1-P4) Avail: NTIS HC $4.50; HC also available $27.00/set of 5 reports as PB-246177-SET CSCL 10A

An outline is given of an incremental test program whose objectives are twofold: (1) to provide solutions to the critical issues such as biofouling, heat exchanger performance, cold water pipe characteristics including pipe attachment and deployment, and plant interaction with the environment such as disturbance of the thermocline; (2) to provide design data, not obtainable solely by analyses, required for the successful design and construction of ocean thermal energy conversion plants. GRA

N76-19569# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION Final Report, 2 Apr. 1973 - 14 Mar. 1975
E. Levy, Jr. and R. J. McGrath Apr. 1975 184 p refs
(Contract F33615-73-C-2060; AF Proj. 3145)
(AD-A015880; SCG-50121R; AFAPL-TR-75-23) Avail: NTIS CSCL 10/2

A unique Solar Cell Blocking Diode for use on solar panels is described. The device has the physical characteristics of a solar cell and the electrical properties of conventional diodes currently used for solar array reverse current isolation and protection. This combination of physical characteristics and electrical properties permits mounting of the diode on the panel surface in series with solar cells, and is particularly useful for flexible rollup solar arrays. The diode junction is diffused into a 1 x 2 cm, 8 mil thick, P-doped silicon blank. Nominal inverse voltage standoff characteristics of 140 volts at 1 mA leakage have been achieved with 20 ohm-cm base resistivity, 6 micrometer diffused junctions, and heavy silicon monoxide layers for surface passivation. Typical forward voltage drop at 0.3/3.0 amperes are of the order of 0.8/1.2 volts. Conventional diodes exhibit nominal inverse voltage standoff characteristics of 100 volts at 25 microamperes leakage, and typical forward voltage drop of 0.8/1.0 volt at 0.3/3.0 amperes. Author (GRA)

N76-19570# Defence Research Establishment Ottawa (Ontario). Electrical Power Sources Div.
CHARGE-DISCHARGE CYCLING OF DREO AIR ELECTRODES
William A. Armstrong Sep. 1975 18 p refs
(AD-A016721; DREO-R-728) Avail: NTIS CSCL 10/3

The effects of the composition of the electrode surface in contact with the electrolyte on the ability of an air cathode to withstand the rigors of oxygen evolution during charging have been investigated. Of the compositions studied, a sintered nickel surface containing silver, mercury and PTFE (polytetrafluoroethylene) exhibited the lowest oxygen evolution potential. With a cycle regime consisting of 1 h oxygen reduction at 26 mA/sq cm followed by 2 h oxygen evolution at the same current density, the oxygen reduction potential decreased by 156 mV during 41 cycles. GRA

N76-19571# Federal Trade Commission, Washington, D.C. Bureau of Competition.

STAFF REPORT TO THE FEDERAL TRADE COMMISSION ON THE STRUCTURE, CONDUCT AND PERFORMANCE OF THE WESTERN STATES PETROLEUM INDUSTRY
Sep. 1975 158 p
(PB-245855/2; FTC-7410018) Avail: NTIS HC $6.75 CSCL 05C

Competitive conditions in the energy industries, using Western States Petroleum as a model, are examined. The report examines the extent of economic concentration in such areas of the market as crude oil production, refining and marketing. It also examines three areas of industry conduct for antitrust implication. Withdrawal from gasoline marketing by major firms in the Pacific Northwest occurring in late 1973, control of intrastate crude oil pipelines in California by major oil firms to the alleged exclusion of independent refiners and producers, and assertions that the major oil firms are holding California crude oil prices down through the exercise of their market power as buyers. An examination was made of the legal issues presented by the question of regulatory jurisdiction over the the Alaska pipeline. GRA

N76-19572# Wisconsin Dept. of Transportation, Madison.
PROCEEDINGS: THE ROLE OF THE US RAILROADS IN MEETING THE NATION'S ENERGY REQUIREMENTS
Oct. 1974 88 p refs Proc. held at Madison, Wisc., 6-8 May 1974 Prepared in cooperation with Wisc. Univ., Madison
(Contract DOT-FR-4-3015)
(PB-245565/7) Avail: NTIS HC $5.00 CSCL 10A

The market role of the railroads given present and forecast changes in energy parameters is discussed in terms of meeting the nation's energy requirements. Other topics covered include: the posture and responsibility of government, environmental issues, and technology, especially the potential for electrification of main lines. GRA

N76-19573# Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
STUDIES ON METHODS OF REDUCING HEAT LOSSES FROM FLAT PLATE SOLAR COLLECTORS Semiannual Progress Report, 1 Aug. 1974 - 31 Jan. 1975
K. G. T. Hollands 28 Feb. 1975 58 p refs
(Grant NSF AER-74-09110)
(PB-245415/5; NSF/RA/N-75-071; NSF/RANN/SE/75-1) Avail: NTIS HC $4.50 CSCL 13A

Improvements to flat plate solar collectors for heating and cooling of buildings are evaluated by three parallel studies. The first study demonstrated that suppression of convective heat transfer by honeycomb panels is possible even when the panel is inclined from the horizontal. The second study resulted in a precise, simple equation for the free convective heat transfer through an inclined air layer. The third study examines the solar transmittance of a V-corrugated inner cover. GRA

N76-19574# General Electric Co., Schenectady, N.Y.
SODIUM-SULFUR BATTERY DEVELOPMENT FOR BULK POWER STORAGE Interim Report
J. B. Bush, Jr. Sep. 1975 112 p refs Sponsored by Electric Power Res. Inst.
(PB-246000/4; EPRI-128-2) Avail: NTIS HC $5.50 CSCL 10C

This report describes the results obtained in one year of a program that has as its long range objective the development of a practical electrical energy load leveling system based on the sodium-sulfur battery. Seventy-six cells of 17-AH capacity, were cycled continuously until failure occured. Mechanical seals, which proved to be easier to make and much more reliable than glass or brazed seals, were used exclusively as the exterior seal for the metal cells tested. A variety of alloys (e.g., 347 stainless steel and aluminum and nonmetallic materials such as silicon carbide) were subjected to corrosion testing, and promising materials were incorporated into prototype cells. The average life of cells to abrupt failure has approximately doubled. This has resulted from the elimination of MgO as an additive to the beta alumina. The techniques of X-ray radiography and cell sectioning as well as application of a variety of analytical methods to the examination of components of ailed cells have proved valuable in establishing causes of capacity decline and abrupt failure. GRA

N76-19575# Colorado Springs Dept. of Public Utilities, Colo.
ASSESSMENT OF A SINGLE FAMILY RESIDENCE SOLAR HEATING SYSTEM IN A SUBURBAN DEVELOPMENT SETTING Annual Report, 1 Jul. 1974 - 31 Jul. 1975
James D. Philips 10 Jul. 1975 244 p refs
(Grants NSF GI-44210; NSF ISR-75-22998-000)
(PB-246141/6; NSF/RA/N-75-078) Avail: NTIS HC $8.00 CSCL 13A

A gas moratorium in 1973 prompted the city of Colorado Springs to investigate alternate methods for space heating. This investigation led to the conclusion that solar heating could become a viable alternative. A community Project to construct and test a solar heated house. This report is the result of one year's intensive investigation into four areas related to solar heating: technical research on the system's components, economic research, legal research on zoning ordinances and building codes, and social acceptance research on the acceptability of solar heating. GRA

N76-19576# Battelle Columbus Labs., Ohio.
ENERGY USE PATTERNS IN METALLURGICAL AND NONMETALLIC MINERAL PROCESSING. PHASE 4: ENERGY DATA AND FLOWSHEETS, HIGH-PRIORITY COMMODITIES
27 Jun. 1975 192 p refs
(Contract S0144093)
(PB-245759/6; BM-OFR-80-75) Avail: NTIS HC $7.50 CSCL 10A

Energy requirements for high-priority primary products are given. These commodities and their appropriate primary products were originally selected for this study because of an expected relatively high total annual energy requirement to produce or because of the large tonnage produced each year. All of these commodities are important basic industrial materials and therefore this detailed energy appraisal is of particular value in assessing the national pattern of energy consumption. Estimated energy values are included for mining and beneficiation, consumable raw materials, transportation, and fuels and electrical energy. GRA

N76-19577# Stanford Research Inst., Menlo Park, Calif.
COMPARISON OF ENERGY CONSUMPTION BETWEEN WEST GERMANY AND THE UNITED STATES Final Report
Richard L. Goen and Ronald K. White Jun. 1975 112 p refs
(Contract DI-14-01-0001-1885; SRI Proj. EGU-3519)
(PB-245652/3; FEA/D-75-590) Avail: NTIS HC $5.50 CSCL 10A

The report examines and explains the differences in per capita energy consumption between the United States and West Germany, and quantifies the factors involved. West Germany uses only half as much energy per capita as the United States. Energy use per capita for transportation is only one-fourth of that of the United States, for residential space heating (climate corrected) only one-half, for other residential uses only one-fourth, and for industrial uses 58 percent. The United States uses at least 40 percent more energy for industry in relation to output as West Germany. The total energy use in the United States in relation to national income is about 50 percent greater than in West Germany. This large disparity in energy use between the two countries suggests that continued economic growth and improvement in the standard of living in the United States should be possible without a proportionate increase in energy consumption. GRA

N76-19578# Federal Power Commission, Fort Worth, Tex. Bureau of Power.
THE PHASING OUT OF NATURAL GAS AND OIL FOR ELECTRIC POWER GENERATION. SOUTHWEST POWER POOL AND ELECTRIC RELIABILITY COUNCIL OF TEXAS. PART 1: PRESENT ELECTRIC UTILITY PROGRAM, 1975 - 1984
Sep. 1975 46 p refs
(PB-245570/7) Avail: NTIS HC $4.00 CSCL 10A

The report covers electric utility plans for phasing out natural gas and oil for electric generation in the Southwest Power Pool and Electric Reliability Council of Texas. These two electric reliability councils cover all or parts of eight states ranging from

the western part of Mississippi to the eastern part of New Mexico and stretching from Texas to Kansas and part of Missouri. Because this area is heavily dependent on natural gas as a fuel for electric generation, its use is of major concern and importance in the face of a diminishing natural gas supply. GRA

N76-19579# Purdue Univ., Lafayette, Ind. School of Chemical Engineering.
TURBULENT BED COOLING TOWER Final Report
Ronald G. Barile May 1975 36 p refs
(Grant EPA-B-801867)
(PB-245840/4; EPA-660/2-75-027) Avail: NTIS HC $4.00 CSCL 10A

The purpose of this work is to determine whether the turbulent bed contactor (TBC), a relatively new and efficient device commonly used for gas scrubbing, can be proven as a competitive cooling system in electric power generation. The turbulent bed employs light, hollow plastic spheres as a packing which fluidize as air flows upward through the bed, while water is sprayed downward over the bed. It was desired to demonstrate the feasibility, collect sufficient data to permit scaleup design, and estimate the investment and costs involved. Pressure drop and cooling performance of the bed were measured for the air-water system in a vertical column, under conditions typical of industrial cooling tower applications. Results indicate that the TBC performed marginally as compared with conventional mechanical draft cooling towers. GRA

N76-19580# Pennsylvania State Univ., University Park. Dept. of Architectural Engineering.
EVALUATION OF THE SOLAR BUILDING, ALBUQUERQUE, NEW MEXICO Annual Report, 1 Apr. - 31 Dec. 1974
Stanley F. Gilman 31 Jan. 1975 50 p refs
(Grant NSF GI-43922)
(PB-245392/6; NSF/RA/N-75-076) Avail: NTIS HC $4.00 CSCL 13A

A procedure was developed for designing solar energy assisted heat pump systems for commercial buildings. A building in Albuquerque, N. M. was instrumented and equipped with a computerized data acquisition system. Various operating modes and operating data are covered. GRA

N76-19581# New York State Atomic and Space Development Authority, N.Y.
AN APPRAISAL OF ELECTRICAL ENERGY ALTERNATIVES AVAILABLE TO THE STATE OF NEW YORK, VOLUME 1. SUMMARY REPORT, VOLUME 2 Technical Report on Phase 1, 1 Mar. - 31 Aug. 1974
Martin Becker 31 Aug. 1974 358 p refs Prepared by Rensselaer Polytech. Inst.
(PB-245995/6; NYSERDA-75/01-Vol-1/2) Avail: NTIS HC $10.50 CSCL 10A

Results are presented of a study of the alternate strategies that could be adopted to meet power supply requirements in New York State in the short and long term (1975-1985; 1985-2000). The traditional capital and fuel cost criteria are considered as well as other factors such as environmental and health implications, State and National economic policies, land use. Key aspects are described of the data base to be used as inputs to the mathematical model being developed to describe the interrelationships of the various criteria as may influence the decision making process. GRA

N76-19582# Massachusetts Univ., Amherst.
A SURVEY OF THE POSSIBLE USE OF WINDPOWER IN THAILAND AND THE PHILIPPINES
William E. Heronemus Nov. 1974 143 p refs
(Contract AID/ta-c-1143)
(PB-245609/3) Avail: NTIS HC $6.00 CSCL 10A

Use of wind powers by the peasant farmer in Thailand or the Philippines to improve the quality of his life was investigated. It was found that windpower was being used to a very limited extent in Thailand to move water, thus relieving either a backbreaking manual labor task, or a very expensive out-of-pocket expenditure for fuel for engine driven pumps. No evidence of existing wind pumping could be found in the Philippines.GRA

N76-19583# Federal Energy Administration, Washington, D.C. Oil and Gas Statistics Div.
ENERGY INFORMATION REPORTED TO CONGRESS AS REQUIRED BY PUBLIC LAW 93-319, SECOND QUARTER 1975 Quarterly Report
1975 197 p
(PB-242760-02) Avail: NTIS HC $10.00 (special price)/MF $10.00 (special price); HC also available on subscription $35.00/year domestic, $45.00/year foreign CSCL 10A

Resource development, coal, natural gas, crude oil, refined petroleum products, nuclear energy, and electric power are discussed. Topic areas cover such things as demand, reserves, consumption, and international trade. GRA

N76-19584# Westinghouse Research Labs., Pittsburgh, Pa.
FLUIDIZED BED COMBUSTION PROCESS EVALUATION. PHASE 2: PRESSURIZED FLUIDIZED BED COAL COMBUSTION DEVELOPMENT Final Report, Jun. 1973 - Dec. 1974
D. L. Keairns, D. H. Archer, J. R. Hamm, S. A. Jansson, B. W. Lancaster, E. P. ONeill, C. H. Peterson, C. C. Sun, E. F. Sverdrup, and E. J. Vidt Sep. 1975 480 p refs
(Contract EPA-68-02-0605)
(PB-246116/8; EPA-650/2-75-027C) Avail: NTIS HC $12.50 CSCL 07A

Results are given of a program to evaluate and develop pressurized fluidized-bed coal combustion. The historical, technical, and economic aspects of fluidized bed combustion (FBC) systems have been reviewed, systems analyses performed, commercial plant design and cost estimates prepared, and experimental data on the sulfur removal system obtained. Other topics discussed include: Collection and analysis of data on critical system parameters; development of process options; and assessment of power plant cycles and component designs. GRA

N76-19585# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF NEW CELL COMPONENTS FOR VENTED NICKEL-CADMIUM BATTERIES
Otto C. Wagner Nov. 1975 22 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-A017117; ECOM-4364) Avail: NTIS CSCL 10/3

An investigation of new cell components for vented nickel-cadmium batteries shows that it is possible to prevent capacity loss due to crystal growth of cadmium and cadmium hydroxide by the addition of 1% indium hydroxide to the active cadmium powder. Cadmium anodes with 5% nickel hydroxide were found to be partially effective in resisting crystal growth. The investigation also shows that the low temperature performance of vented nickel-cadmium cells (-20F) with methacrylic acid-grafted polyethylene membranes, E-2291 (40/20), is equal to that of cells with standard cellophane membranes if the former are initially formed by means of an optimized pulse mode of charging (based on USAF data, the room temperature life of vented nickel-cadmium batteries with E-2291 separator is about five times greater than standard batteries with cellophane membranes). GRA

N76-19586# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Jun. - 31 Aug. 1975
A. N. Dey Nov. 1975 32 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94)
(AD-A017005; ECOM-74-0109-6; QR-6) Avail: NTIS CSCL 10/3

The voltage delay characteristics of the D cells after a storage of 3 months at 72C and test at -30C appeared to have improved as a result of increasing the electrode area (by increasing the width of the Li anode from 1.5 inches to 1.75 inches) and the partial discharge. The safe venting pressure, determined from the quantitative measurements of the cell pressure on external heating and shorting, was found to be less than 200 Psig. Short circuiting and forced discharging were carried out with D cells having a low pressure vent. It was found that although the cell explosions from shorting were preventable by using a particular low pressure vent design; this design was ineffective for forced overdischarge at currents of 0.5 and 0.25A. It is also important to note that the cell wall temperatures at which the cells exploded on overdischarge were only slightly above the ambient, viz 34

and 39C. Use of diode protection need to be considered since overdischarge of a cell may occur in a multicell battery during normal usage. GRA

N76-19587# ARO, Inc., Arnold Air Force Station, Tenn.
RESULTS OF TESTING THE AEDS 5-MN SEGMENTED ARC HEATER AT PRESSURES UP TO 171 ATM Final Report, 10 Oct. 1974 - 27 Feb. 1975
Dennis P. Horn and Richard T. Smith AEDC Nov. 1975 37 p refs
(AD-A017288; ARO-PWT-TR-75-85; AEDC-TR-75-127) Avail: NTIS CSCL 13/1

The results of testing a nominal 5-MW segmented (constrictor-channel type) arc heater are presented. The heater was operated at chamber pressures up to 171 atm and power inputs to nearly 4 MW using air as the test gas. The nozzle exit flow was surveyed with a null-point calorimeter, pressure, and enthalpy probes. Performance comparisons are made between the segmented and other types of arc heaters and with an analytical correlation program. Detailed test and data summaries are presented. GRA

N76-19588# Columbia Univ., New York. Chemical Engineering Research Labs.
INVESTIGATION OF A HIGH ENTHALPY AIR ARC HEATER
S. F. Kang, J. Fink, and C. Sheer Aug. 1975 69 p refs
(Grant AF-AFOSR-2625-74; AF Proj. 9783)
(AD-A017584; AFOSR-75-1460TR) Avail: NTIS CSCL 13/1

An experimental program was undertaken to develop a high enthalpy arc heater using air as the working fluid. Structurally the heater consists of a fluid convection cathode (FCC) and a ring anode. The FCC consists of a conical tungsten cathode surrounded by a concentric, closely-spaced shroud to form an annular nozzle to inject part of the working fluid into the base of the arc column. The ring anode features a central aperture, serving as the arc anode, and an annular nozzle to inject the remainder of the working fluid into the column near the anode end of the arc. Both cathode and anode gas flows provide some gas-film cooling of the respective electrodes. A parametric study was made of the heater operation by varying arc current, gas flow rates and various geometrical factors using successively argon, nitrogen and finally air, as the working fluid. GRA

N76-19589# Naval Academy, Annapolis, Md. Environmental Protection Research and Development Team.
COST BENEFIT OF UTILIZING THERMAL STORAGE FOR PEAK COOLING POWER LEVELING
Bruce H. Morgan 19 Sep. 1975 21 p refs
(AD-A017297; USNA-EPRD-13) Avail: NTIS CSCL 13/1

Calculations indicate that provision for diurnal ice storage, reducing peak air conditioning power demand, would save money by decreasing the amount and therefore the cost of the electrical generating equipment which must be installed. The thermal storage facility of a solar heating system might be used for this purpose, perhaps with chilled water rather than ice. GRA

N76-19590# EIC, Inc., Newton, Mass.
SULFUR-BASED LITHIUM-ORGANIC ELECTROLYTE SECONDARY BATTERIES Quarterly Report, 4 Mar. 1975 - 3 Jun. 1975
Gerhard L. Holleck and Joseph R. Driscoll Nov. 1975 43 p refs
(Contract DAAB07-74-C-0072; DA Proj. 1T1-61102-A-34A) (AD-A017642; C-405-6; ECOM-74-0072-6; QR-4) Avail: NTIS CSCL 10/3

This program is aimed at developing a rechargeable organic-electrolyte lithium battery to operate over the range -40 to +160F, have an energy density approaching 100 Whr/lb, a cycle life in excess of 500, and high charge retention. The approach is to use positive electrodes based on higher sulfides of Nb, Ti and V. Ti disulfides and trisulfides were prepared thermally. Both sulfides are electrochemically active and show similar overall behavior. Charge-discharge cycles in PC and methyl acetate (LiALCl4, LiClO4) electrolytes are characterized by relatively flat voltage plateaus with mid-discharge potentials of 2.0V. The discharge cutoff potential, the sulfide preparation, and the solvent appear to affect the cycling behavior. Charge and discharge reactions of TiS2 electrodes are relatively rapid. Diffusion of Li(+) ions in the sulfide and the electrolyte appear to be rate limiting. GRA

N76-19591# Naval Academy, Annapolis, Md.
SIMULATION FACTORS INVOLVED IN OCEAN THERMAL POWER PLANTS
Brian J. Wegner and Martin E. Nelson Aug. 1975 21 p refs
(AD-A017390) Avail: NTIS CSCL 08/3

The parameters which control the diffusion of heat from an ocean sited nuclear power plant are studied. This problem is sometimes referred to as the thermal plume problem. Dimensional analysis is applied to identify dimensionless groups which are involved in the diffusion of heat from the ocean sited plant.GRA

N76-19592# Texas Governor's Energy Advisory Council, Austin.
POTENTIAL FOR SOLID WASTE AS AN ENERGY SOURCE IN TEXAS Final Report
James E. Halligan and William J. Huffman Nov. 1974 128 p refs Prepared in cooperation with Texas Tech. Univ.
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243351/4; NSF/RA/N-74-255) Avail: NTIS HC $5.75 CSCL 10A

The technology is assessed of solid waste conversion for application to the needs of Texas. The production rate of solid wastes in the municipal, agricultural, and industrial sectors of the state is summarized. The research-development and legislative actions required to implement energy recovery from solid wastes and those locations in Texas where such conservation processes would be feasible are recommended. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-19593 Illinois Univ., Urbana.
THE CHEMICAL CHARACTERIZATION OF AIRBORNE PARTICLES Ph.D. Thesis
Robert Edward Lamb 1975 174 p
Avail: Univ. Microfilms Order No. 76-6832

Thallium in environmental systems can become an extreme health hazard due to its high toxicity, solubility, and capability for methylation. In particular, airborne particles especially in the submicron regions, can contain elevated levels of this metal. Upon inhalation or ingestion, these particles are a major toxic insult to the body. In order to study this problem, a differential pulsed anodic stripping voltammetric technique was developed for determining low levels of thallium in environmental particles. The method was then employed to study the ubiquitousness of the metal in airborne samples, the association between the thallium concentration and particle size in fly ash, and the association of the metal with specific matrices in fly ash. The findings revealed that thallium, although present in fly ash in very high concentrations, was not present to any great extent in airborne samples. Dissert. Abstr.

N76-19594 California Inst. of Tech., Pasadena.
GAS-TO-PARTICLE CONVERSION IN PHOTOCHEMICAL SMOG: GROWTH LAWS AND MECHANISMS FOR ORGANICS Ph.D. Thesis
Steven Ludvic Heisler 1976 215 p
Avail: Univ. Microfilms Order No. 76-6531

Growth of photochemical aerosols by gas-to-particle conversion shapes the size distribution function and affects visibility. Experiments were conducted to determine the growth law or rate of growth as a function of particle size under conditions simulating the Los Angeles atmosphere. Hydrocarbons and oxides of nitrogen were added to ambient air in an 80 cu m Teflon bag exposed to natural solar radiation. The ensuing photochemical reactions resulted in particle growth. The size distribution of the evolving aerosol was measured in the size range above 0.3 microns using a single particle optical counter. From the change in the size distribution with time, the particle growth rate was determined as a function of size and time. The effects

of curvature and chemical composition on the equilibrium vapor pressure are important. These effects result in critical particle sizes below which growth does not occur (Kelvin effect). The growth law was used to compute a smog aerosol size distribution which agreed well with atmospheric measurements.
Dissert. Abstr.

N76-19595 Stanford Univ., Calif.
DEVELOPMENT OF A PROCEDURE FOR FORECASTING LONG-RANGE ENVIRONMENTAL IMPACTS Ph.D. Thesis
Benjamin Schlesinger 1975 150 p
Avail: Univ. Microfilms Order No. 76-5799

A procedure is presented for forecasting long-range environmental impacts of large scale projects. The overall goal of this forecasting procedure is to allow planners and managers to compare proposed development alternatives on a more uniform basis given available environmental knowledge and a set of asssumptions about how a local environment will respond in the future. The methodology developed entails combining a schedule of primary environmental impacts expected as a result of future activities with a matrix of environmental factor relationships. Each term in this cross-impact matrix relates a change in one factor in one year to a change in another factor the following year by a linear multiplier. An extended version of the matrix is proposed that contains additional terms to reflect the impact of several environmental factors changing at the same time. A case study involving strip mining of coal in the northern great plains region of the United States is used to test the procedure's concept and formulation. Dissert. Abstr.

N76-19596*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Sciences and Health Professions.
PARAMETERIZATION OF GASEOUS CONSTITUENCIES CONCENTRATION PROFILES IN THE PLANETARY BOUNDARY LAYER AS REQUIRED IN SUPPORT OF AIRBORNE AND SATELLITE BORNE SENSORS Technical Report, 1 Feb. - 31 Jan. 1975
Earl C. Kindle, Estelle Condon, and Joseph Casas Mar. 1976 15 p refs
(Grant NsG-1127)
(NASA-CR-146307; PGSTR-AP76-21) Avail: NTIS HC $3.50 CSCL 13B

The research to develop the capabilities for sensing air pollution constituencies using satellite or airborne remote sensors is reported. Sensor evaluation and calibration are analyzed including data reduction. The proposed follow-on research is presented. F.O.S.

N76-19597*# Texas Univ. Health Science Center, Houston. School of Public Health.
RESPIRABLE PARTICULATE MONITORING WITH REMOTE SENSORS. (PUBLIC HEALTH ECOLOGY: AIR POLLUTION) Final Report, 1 Jul. 1971 - 31 Oct. 1973
Richard K. Severs Jan. 1974 292 p refs Original contains color illustrations
(Contract NAS9-12041)
(NASA-CR-147504) Avail: NTIS HC $9.25 CSCL 13B

The feasibility of monitoring atmospheric aerosols in the respirable range from air or space platforms was studied. Secondary reflectance targets were located in the industrial area and near Galveston Bay. Multichannel remote sensor data were utilized to calculate the aerosol extinction coefficient and thus determine the aerosol size distribution. Houston Texas air sampling network high volume data were utilized to generate computer isopleth maps of suspended particulates and to establish the mass loading of the atmosphere. In addition, a five channel nephelometer and a multistage particulate air sampler were used to collect data. The extinction coefficient determined from remote sensor data proved more representative of wide areal phenomena than that calculated from on site measurements. It was also demonstrated that a significant reduction in the standard deviation of the extinction coefficient could be achieved by reducing the bandwidths used in remote sensor. Author

N76-19598# Royal Netherlands Meteorological Inst., De Bilt.
MANUAL FOR THE COMPUTER PROGRAM OF THE GAUSSIAN PLUME MODEL [HANDLEIDING VOOR HET COMPUTERPROGRAMMA VAN HET GAUSSISCHE PLUIMMODEL]
E. H. J. Vermaas and F. T. M. Nieuwstadt 1975 80 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-7) Avail: NTIS HC $5.00

The Gaussian plume model, which simulates the dispersion of air pollution, for the calculation of long term averaged concentrations from point and area sources is discussed. The equations of the Gaussian plume model are given. The structure of the computer program is discussed. The input of the program is dealt with, several examples given, and the values of different input parameters discussed. The output of the program, together with some examples, is also discussed. The complete listing of the program, in ALGOL 60, is given. ESA

N76-19599# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
MEASUREMENTS OF ACTIVE BIOMASS CONCENTRATIONS IN BIOLOGICAL WASTE TREATMENT PROCESSES Final Report, 1970 - 1974
F. G. Pohland and S. J. Kang Sep. 1975 153 p refs
(Contract EPA-R-800354)
(PB-246135/8; EPA-600/2-75-029) Avail: NTIS HC $6.75 CSCL 13B

Pure culture with E. coli and/or heterogeneous culture batch studies were conducted on a variety of substrates including glucose, galactose, sucrose, alanine, acetic acid, and selected industrial wastewaters. Also conducted are continuous aerobic or anaerobic culture studies with and without solids recycle. Dehydrogenase activity was monitored along with other parameters to provide comparative and complementary information on the biomass concentration. Dehydrogenase activity was a very sensitive and accurate measure of active biomass throughout the growth phases especially during endogenous growth but showed limitations with the nutrient deficient cultures. GRA

N76-19600# GCA Corp., Bedford, Mass. Technology Div.
PHOTOCHEMICAL OXIDANT MODELING. VOLUME 1: TECHNIQUES APPLICABLE TO HIGHWAY SYSTEM EVALUATION Final Report
F. A. Record, R. M. Patterson, D. A. Bryant, and A. H. Castaline Apr. 1975 108 p refs
(Contract DI-68-02-1376)
(PB-245915/4; GCA-TR-75-11-G-Vol-1; EPA-450/3-75-069-a-Vol-1) Avail: NTIS HC $5.50 CSCL 13B

This report presents a comparative discussion and evaluation of the modeling techniques available to assess the photochemical oxidant air quality impact of highway system modification or development. Five attributes of eight modeling techniques are discussed. The eight methods considered, in order of increasing complexity, are: (1) VMT Change, (2) Linear Rollback, (3) Nonlinear Rollback: Appendix J, (4) Gifford-Hanna Photochemical Model, (5) Statistical Relationships: Diffusion Kinetics Model, and (6) Urban Air Shed Photochemical Simulation Model. For each of these the following five attributes are discussed: (1) applicability and reliability, (2) data and manpower requirements, (3) use of the technique, (4) limitations, and (5) special features. The information presented in this report gives guidance towards choosing a model best suited to a given need, based on compatibility with these attributes. GRA

N76-19601# GCA Corp., Bedford, Mass. Technology Div.
PHOTOCHEMICAL OXIDANT MODELING. VOLUME 2: DETAILED TECHNICAL REPORT Final Report
Robert M. Patterson, Michael T. Mills, Elaine P. V. Ward, David A. Bryant, and Rebecca C. Galkiewicz Apr. 1975 151 p refs
(Contract EPA-68-02-1376)
(PB-246208/3; EPA-450/3-75-069-b-Vol-2) Avail: NTIS HC $6.75 CSCL 13B

This report describes review and analysis activities which have been undertaken to support the EPA goal of developing technical and policy guidelines for assessing the oxidant air quality impact of highway development under the 3-C planning process. Separate sections discuss somewhat diverse topics, although they are all directed towards oxidant impact assessment. These sections include (1) a review of the techniques and computer models available for estimating mobile source emissions; (2) a brief summary of oxidant formation processes; (3) a discussion of

the oxidant modeling activities of this projection using the DIFKIN and Gifford-Hanna photochemical models, and (4) a 'test run' of the 109(j) and indirect source review guidelines. GRA

N76-19602# Tabershaw/Cooper Associates, Inc., Rockville, Md.
A CRITICAL EVALUATION OF CURRENT RESEARCH REGARDING HEALTH CRITERIA FOR SULFUR OXIDES
H. M. D. Utidjian, W. R. Gaffey, E. L. Husting, and L. R. Tabershaw 11 Apr. 1975 128 p refs Sponsored by Federal Energy Admin.
(PB-245651/5; FEA/D-75-294) Avail: NTIS HC $6.00 CSCL 06T

The scientific and technical bases are considered or the ambient air quality standards for sulfur dioxide (SO2) and its derivatives, jointly designated 'Sulfur Oxides' (SOx) in community atmospheres. The evidence bearing on SOx is evaluated and separated from the overall measurements and health effects of community air pollution. Oil, coal, and shale, when burned as energy sources, release sulfur oxides into the air and hence, the AAQS for SO2 becomes a crucial determination of the acceptability of such fuels. The ability of the body to absorb the toxicant is considered in relation to functional and metabolic factors and defense mechanisms which negate, enhance, or modify the effect. GRA

N76-19603# National Center for Atmospheric Research, Boulder, Colo.
ACTINIDES IN THE ENVIRONMENT AND THEIR UPTAKE BY MAN
Edward A. Martell May 1975 54 p refs Sponsored by NSF
(PB-245727/3; NCAR-TN/STR-110) Avail: NTIS HC $4.50 CSCL 06F

Environmental transport of plutonium (Pu) is governed initially by the physical and chemical properties of liquid and airborne effluents and subsequently by the modification of these properties in terrestrial and marine environments. An assessment of inhalation exposure is particularly dependent on the size distribution of PuO2 in airborne effluents, the air reentrainment of deposited PuO2 by natural processes, and the recycling of PuO2 by human and vehicular activity. GRA

N76-19604# Midwest Research Inst., Kansas City, Mo.
PARTICULATE REMOVAL FROM GAS STREAMS AT HIGH TEMPERATURE/HIGH PRESSURE Final Report
A. K. Rao, M. O. Schrag, and L. J. Shannon Aug. 1975 83 p refs
(Contract EPA-68-02-1324)
(PB-245858/6; EPA-600/2-75-020) Avail: NTIS HC $5.00 CSCL 07A

Results are given of an evaluation of methods of removing particulate matter from high temperature and/or high pressure gas streams. Theoretical and experimental information indicates that in many instances the effectiveness of collection and agglomeration mechanisms decreases with increases in temperature and pressure. Control equipment and systems which offer promise for application to particulate cleanup under high temperature and/or high pressure conditions are discussed. All potential systems reviewed require considerable development before they can be used reliably under the conditions of interest. GRA

N76-19605# Karolinska Institutet, Stockholm (Sweden).
CADMIUM IN THE ENVIRONMENT, 3. A TOXICOLOGICAL AND EPIDEMIOLOGICAL APPRAISAL Final Report
Lars Friberg, Tord Kjellstrom, Gunnar Nordberg, and Magnus Piscator Jun. 1975 218 p refs
(Contract EPA-68-02-1210)
(PB-246115/0; EPA-650/2-75-049) Avail: NTIS HC $7.75 CSCL 06T

A review of biomedical literature on cadmium is presented. Topics discussed include: problems, of analysis; occurrence, possible routes of exposure, and daily intake; uptake and absorption; transport, distribution, and excretion of cadmium in animals; transport distribution, and excretion of cadmium in normal and exposed human beings; metallothionein: occurrence and properties; respiratory, renal, liver, and bone effects; effects on calcium and vitamine D metabolism; effects on the cardiovascular system; effect on the testicles; teratogenic effects; acute systemic effects of cadmium injection: studies in relation to chronic effects and the possible influence of metalliothionein; and carcinogenic and genetic effects. GRA

N76-19606# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Medical and Biologic Effects of Environmental Pollutants.
NICKEL
Mar. 1975 284 p
(Contract EPA-68-02-0542)
(PB-245123/5; ISBN-0-309-02314-9) Avail: NTIS MF $2.25; HC avail. from Printing and Publishing Office, Natl. Acad. of Sciences, 2101 Constitution Ave., Washington, D. C. 20418 CSCL 06F

A comprehensive survey of nickels relation to health is given. Factors described include the natural sources of nickel and the production of nickel from its ores; its physical and chemical nature; its measurement; its relation to other pollutants; the manufacturing processes that use nickel; the recycling of nickel in the biosphere; occupational hazards from nickel; and community exposures and margins of safety. Information is also presented on experimental studies related to the metabolism, toxicity, carcinogenicity, and mutagenicity of nickel and its compounds. Recommendations for monitoring and controlling nickel in the environment are presented. GRA

N76-19607# Brigham Young Univ., Provo, Utah. Dept. of Mathematics.
ECOSYSTEM ANALYSIS AND PREDICTION
Simon A. Levin Jul. 1974 348 p refs Presented at Proc. of a SIAM-SIMS Conf. on Ecosystems, Alta, Utah, 1-5 Jul. 1974 Sponsored by NSF
(PB-246391/7) Avail: NTIS HC $10.00 CSCL 06F

The degree to which mathematics has contributed, is contributing, and may contribute to solving the problem of the prediction of the response of ecosystems to perturbations is assessed. The conference report contains the papers presented at the conference, several additional post-conference contributions, and a summary of the discussion of each paper. The major topics discussed are: the threshold problem in ecosystems; difficulties in modelling populations; population-community and population-ecosystem interfaces; ecosystem level concepts; new mathematical constructs and directions; and the use of control theory in ecosystem management. GRA

N76-19608# Environmental Monitoring and Support Lab., Cincinnati, Ohio. Radiochemistry and Nuclear Engineering Branch.
RADIOCHEMICAL METHODOLOGY FOR DRINKING WATER Environmental Monitoring Series
Herman L. Kreiger Sep. 1975 59 p refs
(PB-245406/4; EPA-600/4-75-008) Avail: NTIS HC $4.50 CSCL 07D

A laboratory manual of radiochemical procedures has been compiled and edited for use in the analysis of specific radionuclides in drinking water; nuclides for whom the Environmental Protection Agency recommended maximum contaminant levels in its interim drinking water standards. The sensitivity of these procedures is at least a factor of ten greater than the present required limits, and is given in the Appendix. Also appended is information on reagent preparation and suggested sources for purchasing special equipment. GRA

N76-19609# Bureau of Mines, Twin Cities, Minn. Metallurgy Research Center.
DECOMPOSITION REACTIONS OF NITROGEN OXIDES IN DIRECT CURRENT GLOW DISCHARGES
D. G. Kuehn, S. E. Khalafalla, and L. M. Chanin Sep. 1975 23 p refs
(PB-245824/8; BM-RI-8063) Avail: NTIS HC $3.50 CSCL 07D

A method is examined that uses electrical discharges to convert the undesired effluent to nonpollutants prior to its emission into the atmosphere. Studies were conducted to determine the positive ions and neutral species produced in glow discharges of gas streams containing 1.0 percent NO in helium, 29 percent dry air in helium, and 1.06 percent NO in N2. Mass spectrographic measurements were conducted for gas pressures from 2.3 to

10.0 torr and dc currents from 10 to 20 mA. Variations in various ionic and neutral species with discharge duration were interpreted to be consistent with an electrically induced dissociation of NO to produce N2 and O2. No nitrogen oxides were observed to form in flow discharges of the helium-air mixture. GRA

N76-19610# California Univ., Irvine. Combustion Lab.
MECHANISMS OF EXHAUST POLLUTANTS AND PLUME FORMATION IN CONTINUOUS COMBUSTION Interim Report, 1 May 1974 - 28 Feb. 1975
G. S. Samuelsen May 1975 28 p refs
(Grant AF-AFOSR-2710-74; AF Proj. 6813; AF Proj. 9711)
(AD-A016063; UCI-ARTR-75-2; AFOSR-75-1288TR) Avail: NTIS CSCL 21/2

The investigation of exhaust pollutant and plume formation in continuous combustion is a combined analytical and experimental study of turbulent, backmixed combustion in gas turbines. Experiments are being conducted operating with premixed methane/air and propane/air reactants. Theoretically predicted profiles of the flow properties are being systematically compared with experimentally determined profiles. The report discusses the following research: The experimental facility has been modified and updated to accommodate the current study; limited emission and velocity data have been obtained; and the analytical phase has been directed to updating the turbulence model used in the original (PISTEP I) ORC numerical program and adapting a p-v, 3-dimensional program dubbed TEACH to the ORC system. GRA

N76-19611# Wisconsin Univ., Milwaukee.
SOME ECONOMIC ASPECTS OF AIR POLLUTION CONTROL WITH SPECIAL REFERENCE TO POLK COUNTY, FLORIDA
Thomas D. Crocker Jan. 1968 347 p refs
(Grant AP-00389-02)
(PB-245799/2) Avail: NTIS HC $10.00 CSCL 13B

The report attempts to clarify the economic analysis and modification of air pollution problems. It also deals with the impact of atmospheric pollution on resource value and use, with particular emphasis upon land and its allocation between receptor and emitter uses. Using Polk County, Florida as its example, it tries to make the information applicable to both local and national air pollution policy. GRA

N76-19612# Calspan Corp., Buffalo, N.Y.
A METHODOLOGY FOR DETERMINING THE EFFECTS OF FUELS AND ADDITIVES ON ATMOSPHERIC VISIBILITY Final Report, Apr. 1973 - Apr. 1975
W. C. Kocmond, J. Y. Yang, and J. A. Davis Jun. 1975 57 p
(Contract EPA-68-02-0698)
(PB-245597/0; CALSPAN-NA-5300-M-1; EPA-650/2-75-068) Avail: NTIS HC $4.50 CSCL 13B

A methodology for determining the effects of fuels and additives on atmospheric visibility developed using the smog chamber approach is described. The methodology involves measuring visibility in a 590 cu m smog chamber after first introducing auto exhaust at a 300:1 detection ratio adding 0.05 ppm SO2 and irradiating the sample for 23 hours. The effects on test results of exhaust dilution ratio, relative humidity, added SO2, primary particulates, evaporative emissions and irradiation time are discussed. The tests show that using commercial grade indolene fuel, the effects on visibility of the additives F-310 and C1-2 are small compared to the effects brought about by variations in engine performance. GRA

N76-19613# Bureau of Mines, Spokane, Wash. Mining Research Center.
PHYSICAL PROPERTY DATA ON FINE COAL REFUSE
R. A. Busch, R. R. Backer, L. A. Atkins, and Daniel Kealy Sep. 1975 46 p refs
(PB-245841/2; BM-RI-8062) Avail: NTIS HC $4.00 CSCL 08I

The subsurface physical property data developed on the fine coal waste materials that make up the core areas of two typical coal waste impoundments are presented. Additional calorific, chemical, and mineralogical data were obtained on the coal waste materials to determine possible uses or development of byproducts. The possibility of extracting alumina from coal ash was also investigated. To obtain more information on coal sludge, especially at various depths, a sampling program was carried out on two typical waste piles. Laboratory tests were performed on these samples to provide data that could be used to evaluate problems involving drainage, liquefaction, strength, and stability. GRA

N76-19614# Systems Control, Inc., Palo Alto, Calif.
A QUANTITATIVE METHOD FOR EFFLUENT COMPLIANCE MONITORING RESOURCE ALLOCATION Final Report
Arthur I. Cohen, Yaakov Bar-Shalom, Wendy Winkler, and G. Paul Grimsrud Sep. 1975 259 p refs
(Contract EPA-68-01-2232)
(PB-245411/4; EPA-600/5-75-015) Avail: NTIS HC $9.00 CSCL 13B

A quantitative method is developed for the preliminary design of effluent standard surveillance systems. The principal output is a procedure to be used in the state or EPA water quality programs to determine the frequency of effluent compliance monitoring visits. The procedure allocates compliance monitoring budgetary resources so as to minimize environmental damage. It uses a statistical model of the effluents that is obtained from self monitoring and compliance monitoring data. The procedure is demonstrated on an example river basin using data supplied by the State of Michigan. GRA

N76-19615# Onondaga County Solid Waste Disposal Authority, Syracuse, N.Y.
EVALUATION OF SHREDDING FACILITIES ROCK CUT ROAD PLANT NO. 1. ONONDAGA COUNTY SOLID WASTE DISPOSAL AUTHORITY, ONONDAGA COUNTY, NEW YORK Final Report
1975 148 p refs
(Contract EC-00316)
(PB-245672/1; EPA-530/SW-86D) Avail: NTIS HC $6.00 CSCL 13B

An Eidal Model SW-1150 solid waste shredder is evaluated. A description of the process; the facility throughput; power requirements; wear rates and predicted life of equipment; operating problems including jams, fires, and electrical problems; discharge particle size, maintenance; and cost data are included. Recommendations are also listed to improve the performance of this type of operation. GRA

N76-19616# TRW Environmental Services, Vienna, Virg.
IMPLEMENTATION PLAN REVIEW FOR VIRGINIA AS REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT Final Report
Feb. 1975 57 p refs
(Contract EPA-68-02-1385)
(PB-245833/9; EPA-450/3-75-016) Avail: NTIS HC $4.50 CSCL 13B

Revisions of control regulations for stationary fuel combustion sources which do not interfere with attainment and maintenance of the national ambient air quality standards are presented. The changes would make it possible to alter fuel resource allocations to provide clean fuel savings in a manner consistent with environmental and national energy needs. GRA

N76-19617# Systems Technology Corp., Dayton, Ohio.
A TECHNICAL, ENVIRONMENTAL AND ECONOMIC EVALUATION OF THE WET PROCESSING SYSTEM FOR THE RECOVERY AND DISPOSAL OF MUNICIPAL SOLID WASTE Final Report
1975 223 p refs
(Contract EPA-68-01-2211)
(PB-245674/7; EPA-530/SW-109c) Avail: NTIS HC $7.75 CSCL 13B

A technical, economic, and environmental evaluation is given for a wet pulping process used for the recovery and disposal of municipal solid waste. The demonstration facility consists of three major systems: hydrasposal, fiber recovery, and glass and aluminum recovery. This report presents the data for the hydrasposal and fiber recovery systems only. GRA

N76-19618# Research Triangle Inst., Research Triangle Park, N.C.
UPDATE AND IMPROVEMENT OF THE CONTROL COST SEGMENT OF THE IMPLEMENTATION PLANNING PRO-

GRAM Final Report
F. L. Bellegia, J. C. Mathews, R. E. Paddock, and M. M. Wisler Feb. 1975 150 p refs
(Contract EPA-68-02-0607)
(PB-245834/7; EPA-450/3-75-058) Avail: NTIS HC $6.00 CSCL 13B

Most point source emitters of sulfur dioxide and particulate matter are identified and assigned a four-digit Standard Industrial Classification (SIC) Code and a two-digit process code. The latter specifically identifies the process taking place within the SIC. Particulate matter and sulfur dioxide control equipment applicable to each SIC-process code combination are identified, and typical removal efficiencies reported. Tandem control arrangements are also considered. Algorithms are developed for estimating the costs associated with installing and operating the control equipment identified as applicable to the SIC-process code combinations. GRA

N76-19619# National Oceanic and Atmospheric Administration, Washington, D.C.
REPORT TO THE CONGRESS ON OCEAN DUMPING RESEARCH, JANUARY THROUGH DECEMBER 1974, PUBLIC LAW 92-532, TITLE 2, SECTION 201 Annual Report
Jun. 1975 58 p refs
(COM-75-11410/8; NOAA-75091603; AR-2) Avail: NTIS HC $4.50 CSCL 13B

Significant Federal research programs and activities carried out in 1974 are reported. It also includes a summary of 1974 studies relative to the requirements of Section 203. It contains sections on research on ocean disposal of dredge and nondredged material, dumpsite characterizations, Coast Guard R and D for ocean dumping surveillance and enforcement, dredged material disposal in the Great Lakes, and research on alternatives to ocean dumping. During 1974 approximately 130 million tons of material were dumped in U.S. coastal waters. Dredged material accounted for 118 million tons, or over 90% of the total tonnage dumped in 1974. Dredged material is an environmental concern because of the large quantities involved and the presence of contaminated sediments. GRA

N76-19620# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION: SYMPOSIUM ON LOW POLLUTION POWER SYSTEMS DEVELOPMENT
1974 819 p
(PB-245316/5; NATO/CCMS-39) Avail: NTIS HC $12.50 CSCL 13B

The problems relating to conventional vehicle engines and measures designed to reduce emission, specifically in the light of improving fuel economy, are discussed. Recent findings in the field of operational procedures for Otto and diesel engines indicate numerous possibilities for reducing emissions and simultaneously improving the existing methods of operation. Special attention is paid to the problems linked with the use of alternative fuels for motor vehicle engines. International exhaust emissions legislation, the development of new motor power systems as well as the development of components for conventional and new engines and criteria for new power systems are discussed. GRA

N76-19621# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION: AIR POLLUTION PILOT STUDY Final Report
1974 42 p
(PB-245319/9; NATO/CCMS-33) Avail: NTIS HC $4.00 CSCL 13B

The objective of the Pilot Study was to develop and enhance air quality management and dealt with the three elements most common to all national programs. They were: (1) the development of air pollution assessment methodology through studies of individual cities within member countries, (2) development of air pollution criteria on the effects of major air pollutants, and (3) technical review and publication of state-of-the-art information on control technology for major pollutants. Development of low pollution power systems was undertaken during the course of the study. The report briefly discusses recommendations of the working group. GRA

N76-19622# Virginia Highway and Transportation Research Council, Charlottesville.
EVALUATION OF EXPERIMENTAL FLEXIBE PAVEMENTS Interim Report
K. H. McGhee Aug. 1975 41 p refs Sponsored by DOT
(PB-245974/1; VHTRC-76-R1; IR-2) Avail: NTIS HC $4.00 CSCL 13B

Among the major findings of the study are: (1) pavements having equivalent design thickness indices are not necessarily equivalent in cost or early structural strength; (2) full depth asphaltic concrete pavements can give excellent performance in very poor soil areas, especially when the subgrade is modified with cement stabilization; (3) transverse shrinkage cracks reflect from a cement treated stone subbase through 3 in. (75 mm) of bituminous concrete in as little as 18 months and through 7 in. (175 mm) of bituminous concrete in less than 5 years; and (4) in some cases cement treatment of stone subbases can be omitted in passing (nontruck) lanes with no detriment to performance. GRA

N76-19623# Syracuse Univ., N.Y. Life Sciences Div.
ENVIRONMENTAL HAZARD ASSESSMENT OF ONE AND TWO CARBON FLUOROCARBONS Final Report
P. H. Howard, P. R. Durkin, and A. Hanchett Sep. 1974 260 p refs
(Contract EPA-68-01-2202)
(PB-246419/6; SURC-TR-74-572.1; EPA-560/2-75-003) Avail: NTIS HC $9.00 CSCL 13B

This report reviews the potential environmental hazard from the commercial use of large quantities of saturated, one and two carbon fluorocarbon compounds which are used for the most part as aerosol propellants, refrigerants, solvents, foaming agents, and fire extinguishing agents. Information on physical and chemical properties, production methods and quantities, commercial uses and factors affecting environmental contamination as well as information related to health and biological effects are reviewed. GRA

N76-19624# Syracuse Univ., N.Y. Life Sciences Div.
INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: HALOETHERS Final Report
Patrick R. Durkin, Philip H. Howard, and Jitendra Saxena Sep. 1975 178 p refs
(Contract EPA-68-01-2996)
(PB-246356/0; SURC-TR-75-561; EPA-560/2-75-006) Avail: NTIS HC $7.50 CSCL 13B

The potential environmental hazard from the commercial use of haloether compounds is examined. The fluorinated anesthetic ethers, methoxyfurane (2,2-dichloro-1,1-difluoroethyl methyl ether) and fluroxene (2,2,2-trifluoroethyl vinyl ether), are only peripherally treated. Major focus is on the alpha-chloroethers, bis(chloromethyl) -ether and chloromethyl methyl ether, and the beta-chloroethers, bis(2-chloroisopropyl)-ether, bis(2-chloroethyl) ether, and bis(2-chloroethoxy)methane. Specific topics discussed include the following: physical and chemical data; environmental exposure factors; health and environmental effects; regulations and standards; summary and conclusions. GRA

N76-19625# Rutgers Univ., New Brunswick, N.J. Dept. of Ceramics.
CHARACTERIZATION OF HIGH TEMPERATURE INCINERATOR SLAGS
James W. Rue and John B. Ings Jun. 1975 76 p
(Grant BM-GO-122115)
(PB-246985/6; BM-OFR-95-75) Avail: NTIS HC $5.00 CSCL 13B

High temperature incineration was evaluated as a potential solution to the management of municipal refuse. This potential is manifested in established major advantages, such as up to 97.5 percent volume reduction, separation in the molten state to a metal and glass residue and reduction of pollution problems. The full potential of high temperature incineration can be realized if the residue is considered a raw material resource for conversions to useful metallic and ceramic products. To achieve such a realization the metallic and glass residue must be characterized

in terms of process variables. A number of process variables were screened that could alter the final material properties of the metal and glass residue. Such variables were combustion atmosphere, garbage composition, incinerating temperature, and length of soak. The most important of these variables were investigated in terms of their effect on measured chemical, physical, and microstructure properties. GRA

N76-19626# Rhode Island Univ., Kingston.
MOVEMENT OF TRACE METALS WITH PERCOLATING WATER Technical Report, 1 Jul. 1973 - 30 Jun. 1975
Mian C. Wang and Vito A. Nacci 30 Jun. 1975 42 p refs
(Contract DI-14-31-0001-5040)
(PB-246104/4; W76-00374; OWRT-A-052-RI(1)) Avail: NTIS HC $4.00 CSCL 13B

The parameters that were considered to affect the metal ion movement in soil included: soil texture, type and content of clay mineral, metal ion, hydraulic conditions, temperature and acidity. Several native soils and commercial clays were used to study the soil-metal ion interaction and movement of metal ions through the soils was determined by using soil lysimeters. The adsorption ability of the soils proved to be related to such soil physical properties as percent of clay size and plasticity index and the chemical property cation exchange capacity. The adsorption of Cu(++) was considerably faster than that of Pb(++) for two native soils. GRA

N76-19627# Raytheon Co., Sudbury, Mass. Equipment Div.
REMOTE MEASUREMENT OF POWER PLANT SMOKE STACK EFFLUENT VELOCITY Final Report
C. M. Sonnenschein Aug. 1975 127 p refs
(Contract EPA-68-02-1752)
(PB-245792/7; EPA-650/2-75-062) Avail: NTIS HC $6.00 CSCL 13B

Demonstration is described of the ability of a CO2 Laser Doppler Velocimeter (LDV) to measure remotely the velocity of the effluent from a power plant smoke stack. The basis of the technique is that laser radiation backscattered from particulates in the effluent is Doppler shifted infrequency in proportion to the velocity of the effluent. Measurements were made against a coal burning power plant equipped with electrostatic precipitators to remove particulates from the boiler flue gases. Based on the results of the measurements a study on the design of an LDV optimized for the measurement of power plant effluent velocities was performed. GRA

N76-19628# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
LABORATORY MODELING OF THERMAL STRUCTURE IN STAGNANT WATER
R. Viskanta, D. M. Snider, and M. Behnia Jun. 1975 82 p refs Sponsored by Dept. of Interior
(PB-245763/8; TR-62; W76-00199; OWRT-A-029-IND(10)) Avail: NTIS HC $5.00 CSCL 13B

Thermal stratification induced by solar radiation and cooling of thermally stratified and unstratified water from the surface was modeled in a laboratory to gain improved understanding of temperature structure in lakes, reservoirs, and ponds. Understanding of internal physical processes in stagnant waters is required in order to develop predictive models for complex hydraulic systems on a steady and unsteady basis. Experimentally, solar radiation was simulated by tungsten filament lamps in parabolic reflectors of known spectral radiation characteristics. The unsteady temperature distribution resulting from radiant heating of pure water in a glass-walled test cell was measured with a Mach-Zehnder interferometer. GRA

N76-19629# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.
SEMIANNUAL REPORT BY THE COMMITTEE ON MOTOR VEHICLE EMISSIONS OF THE NATIONAL ACADEMY OF SCIENCES TO THE ENVIRONMENTAL PROTECTION AGENCY
Jan. 1972 86 p
(Contract EPA-68-01-0402)
(PB-245791/9) Avail: NTIS HC $5.00 CSCL 13B

The technological feasibility of emission controls, anticipated costs, and the estimated time for the design, development, and mass production of an engine, control system, or device capable of meeting the standards are reported. GRA

N76-19630# National Academy of Sciences - National Research Council, Washington, D.C.
INTERIM STANDARDS REPORT BY THE COMMITTEE ON MOTOR VEHICLE EMISSIONS OF THE NATIONAL ACADEMY OF SCIENCES TO THE ENVIRONMENTAL PROTECTION AGENCY
Apr. 1972 22 p refs
(Contract EPA-68-01-0402)
(PB-245806/5) Avail: NTIS HC $3.50 CSCL 13B

Factors that must be considered in the development of interim standards that are technologically feasible for 1975 model year vehicles include: the emission control now being achieved on experimental prototypes of 1975 systems at low mileage, the expected deterioration in emission control over the 50,000 mile or five year useful life of the vehicle, slippage in emission control in transferring from experimental to production vehicles, manufacturing lead times and mass production capabilities, and the anticipated severity of performance and driveability problems. GRA

N76-19631# Mitre Corp., McLean, Va.
TEST EVALUATION OF CAT-OX HIGH EFFICIENCY ELECTROSTATIC PRECIPITATOR Final Report, Sep. - Dec. 1974
E. M. Jamgochian, N. T. Miller, and R. Reale Aug. 1975 103 p refs
(Contract EPA-68-02-0650)
(PB-246647/2; M75-51; EPA-600/2-75-037) Avail: NTIS HC $5.50 CSCL 13B

Results are given of a test program to measure the performance of the high efficiency Research-Cottrell electrostatic precipitator (ESP) located at the Wood River Power Station, East Alton, Illinois. The overall efficiency of the ESP was measured as a function of steam generator and ESP operating conditions. Of particular interest was the efficiency of the ESP as a function of particle size over the range from 0.01 to 5 micrometers. In addition, fly ash resistivity, gas concentrations, coal analyses, and fly ash analyses were determined. The measured results were compared with those generated by an idealized computer simulation model. GRA

N76-19632# Mitre Corp., McLean, Va.
NATIONAL ENVIRONMENTAL STATISTICAL REPORT Final Report
L. Duncan, D. Elcock, and G. Hollins Oct. 1975 255 p
(Contract EQ5AC0101075)
(PB-246233/1; MTR-6957) Avail: NTIS HC $9.00 CSCL 13B

A variety of environmental and related data are presented in approximately 200 statistical and summary tables. The tables are arranged by data type, under 16 subject sections. These sections are: Air quality, water quality, land use, solid waste and recycling, pesticides and toxic substances, agriculture and food supply, forests and wildlife, water resources, recreation, minerals, energy, transportation, housing, population, economics, and environmental impact statements. GRA

N76-19633# Chicago Univ., Ill. Center for Urban Studies.
THE LOCATION OF INDUSTRIAL WATER USERS AND AIR POLLUTION, AN OVERLOOKED RELATIONSHIP
Danilo J. Santini Jun. 1975 13 p Prepared in cooperation with Argonne Natl. Lab
(Grants NSF AG-352; NSF GI-32989A2)
(PB-246670/4; NSF/RA/E-75-044) Avail: NTIS HC $3.50 CSCL 13B

It is established that water use by polluting industries is responsible for much of the urban concentration of pollutant emissions in the state of Illinois. The need for large volumes of water cause certain polluting industries to locate near water bodies. This limits their location, however, dispersal along reservoirs would improve air quality and limit pollution of large urban areas. The results indicate that adequate water supplies must be provided at alternative locations and the elimination of

water use from the production process by technological means such as air cooling must be made feasible. GRA

N76-19634# Rhode Island Univ., Kingston. Dept. of Pharmacognosy.
FURTHER STUDIES OF THE INTERACTION OF CHLORINE AND ORGANIC MOLECULES IN WATER
Yuzuru Shimizu 1 Jul. 1973 15 p refs
(Contract DI-14-31-0001-4124)
(PB-246274/5; W76-00822; OWRT-B-057-RI(1)) Avail: NTIS HC $3.50 CSCL 07C

The existence of nucleic acids and their derivatives in water has been reported. Unexpectedly large amounts of chlorine are incorporated into the nucleic acids, both RNA and DN. Chlorine attacks the pyrimidine derivatives of nucleic acid first, then attacks the purine derivatives of nucleic acid destructively to form small fragments. 5-chlorocytosine and 5-chlorouracil were isolated from the chlorinated RNA. 5-chlorocytosine but no chlorinated thymine derivatives were isolated from the chlorinated DNA. Lignins were chlorinated with chlorine in water to 17% chlorine content. Vanillin is susceptible to chlorination but caffeine is not. GRA

N76-19635# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
THE FEASIBILITY OF OIL-POLLUTION DETECTION AND MONITORING FROM SPACE, EXAMPLES USING ERTS-1 AND SKYLAB DATA Final Report
Gary C. Goldman and Robert Horvath Aug. 1975 58 p refs
(Contract DOT-CG-24063-A)
(AD-A017098; USCG-D-117-75) Avail: NTIS CSCL 13/2

The necessity of detecting and monitoring an increasing number of coastal oil spills has precipitated an extensive U.S. Coast Guard evaluation of various surveillance methods. The purpose of this study was to determine and demonstrate the present and future utility of space-acquired remote sensor data, as an aid to the Coast Guard in fulfilling its assigned mission in the area of oil pollution detection and monitoring and law enforcement, by specifically evaluating ERTS-1 and SKYLAB capabilities. Various digital-computer and photointerpretation methods were attempted in order to develop, or at least evaluate, the best means of analyzing the data. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-19636 Stanford Univ., Calif.
STATISTICAL ANALYSIS OF MAGNETIC PROFILES AND GEOMAGNETIC REVERSAL SEQUENCES Ph.D. Thesis
Jeffrey Douglas Phillips 1975 143 p
Avail: Univ. Microfilms Order No. 76-5784

The statistical properties of geomagnetic reversal sequences are examined to test the hypothesis that reversals are generated by a Poisson or gamma renewal process. On the basis of results, the simplest stochastic model describing reversals would be an alternating renewal process with a time varying mean and gamma distributed polarity intervals. A new high resolution method for the automated interpretation of magnetic profiles based on a stochastic source model involving random intensities and varying two dimensional basement topography is presented. Several examples comparing estimated magnetic basement with known acoustic basement are included. Dissert Abstr.

N76-19637*# Saad Publications, Karachi (Pakistan).
IONOSPHERIC PROCESSES
V. M. Polyakov, L. A. Shchepkin, E. S. Kazimirovskiy, V. D. Kokourov, and V. Ye. Stepanov Washington NASA Aug. 1975 1005 p refs Transl. into ENGLISH of the book "Ionosfernyye Protsessy" Novosibirsk, USSR, 1968 p 1-536 Sponsored by NASA
(Contract NSF C-505)
(NASA-TT-F-16522) Avail: NTIS HC $28.25 CSCL 04A

Data concerning the structure of the neutral gas atmosphere, solar radiation intensity and photoionization processes are presented. Data regarding ionospheric reactions are also provided. The diffusion of charged particles in the ionosphere is then described. Special attention is given to the vertical electron density distribution resulting from the decreasing flux of electron-ion gas under stationary conditions. Data concerning the ion composition of the ionosphere above 100 km and electron density near its upper boundary are reviewed. The conditions for the formation of the F region are considered. Theories of the formation and movement of heterogeneous accumulations of ionospheric plasma are discussed as well as experimental techniques for their investigation. Finally, the movement of heterogeneous accumulations on the global scale and the relation of ionospheric dynamics with atmospheric dynamics as a whole are discussed. Author

N76-19638*# Georgia Inst. of Tech., Atlanta. Support Services Div.
THEORETICAL AND EXPERIMENTAL STUDIES OF ATMOSPHERIC STRUCTURE AND DYNAMICS, USING HIGH ALTITUDE CHEMICAL RELEASE, RADIO METEOR, AND METEOROLOGICAL ROCKET NETWORK AND OTHER DATA Semiannual Status Report, 1 Sep. 1975 - 29 Feb. 1976
Howard D. Edwards 29 Feb. 1976 53 p refs
(Grant NGL-11-002-004)
(NASA-CR-146433; SASR-27) Avail: NTIS HC $4.50 CSCL 04A

Data collected by the Georgia Tech Radio Meteor Wind Facility during the fall and winter of 1975 are analyzed indicating a relationship between lower thermospheric circulation at mid latitudes and polar stratospheric dynamics. Techniques of measurement of mixing processes in the upper atmosphere and the interpretation of those measurements are described along with a diffusion simulation program based on the Global Reference Atmosphere program. J.M.S.

N76-19639*# Kanner (Leo) Associates, Redwood City, Calif.
TERRESTRIAL LIFE OF EXPLOSIVE METEORITIC CRATERS
A. I. Dabizha and M. S. Krass Washington NASA Mar. 1976 18 p refs Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 5, 1975 p 80-88
(Contract NASw-2790)
(NASA-TT-F-16920) Avail: NTIS HC $3.50 CSCL 08G

The evolution of meteorite craters is discussed, a classification into three types by size is presented and various hypotheses are considered as to the shapes of craters. The results of rigid calculations of the problems of evolution of forms, involving the characteristics and behavior of meteorite craters, the lithosphere and the viscous asthenosphere, and the observed forms of various specific meteorite structures in Canada and the Soviet Union are compared. Fields for further search for meteorite craters on the earth and possible usefulness of such studies are discussed. Author

N76-19640*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVATIONS OF VELOCITY SHEAR DRIVEN PLASMA TURBULENCE
P. M. Kintner, Jr. Feb. 1976 42 p refs
(Contract NAS1-11257; Grant NGL-16-001-043)
(NASA-CR-146508; U-of-Iowa-76-7) Avail: NTIS HC $4.00 CSCL 03A

Electrostatic and magnetic turbulence observations from HAWKEYE-1 during the low altitude portion of its elliptical orbit over the Southern Hemisphere are presented. The magnetic turbulence is confined near the auroral zone and is similar to that seen at higher altitudes by HEOS-2 in the polar cusp. The electrostatic turbulence is composed of a background component with a power spectral index of 1.89 + or - .26 and an intense component with a power spectral index of 2.80 + or - .34. The intense electrostatic turbulence and the magnetic turbulence correlate with velocity shears in the convective plasma flow. Since velocity shear instabilities are most unstable to wave vectors perpendicular to the magnetic field, the shear correlated turbulence is anticipated to be two dimensional in character

and to have a power spectral index of 3 which agrees with that observed in the intense electrostatic turbulence. Author

N76-19641*# California Inst. of Tech., Pasadena. Seismological Lab.
A SURFACE-WAVE INVESTIGATION OF THE RUPTURE MECHANISM OF THE GOBI-ALTAI (4 DECEMBER 1957) EARTHQUAKE
Emile A. Okal [1975] 32 p refs
(Grants NGL-05-002-069; NSF EAR-74-22489)
(NASA-CR-146509) Avail: NTIS HC $4.00 CSCL 08K

Long period records of multiple Love waves from the 1957 earthquake in Mongolia at Pasadena are analyzed and compared to synthetic seismograms, generated by the method of Kanamori. A fit in the time domain shows that the records are not consistent with the previous solution, achieved through a frequency domain analysis of directivity. The solution asks for a shorter rupture of 270 km at a velocity of 3.5 km/s. The focal parameters are constrained by updating all the reported first motion and are found to be: Strike = 103 deg, Dip = 53 deg, Slip = 32 deg. A seismic moment of 1.8 10 to the 28th power dynes-cm is obtained. These figures are also consistent with a time domain analysis of Love waves at Palisades and Strasbourg, and of Rayleigh waves at Pasadena, with a directivity study of Love waves at Pasadena, and with static deformation and isoseismal data. A discussion is given of the relation between moment, magnitude and rupture area, and a comparison is made with other events in the same region: It is concluded that this earthquake does not exhibit an intra-plate behavior, but rather compares better with inter-plate events, such as the great Assam earthquake. Author

N76-19642# Israel Program for Scientific Translations, Ltd., Jerusalem.
NOCTILUCENT CLOUDS
V. A. Bronshten and N. I. Grishin 1976 243 p refs Transl. into ENGLISH of the book "Serebristye Oblaka" Moscow, Nauka Press, 1970 Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50009; ISBN-0-7065-1507-2) Avail: NTIS HC $8.00

A survey of theoretical, experimental and observational information on noctilucent clouds is presented. The history of noctilucent cloud research is first described. The distribution and frequency of occurrence of the clouds are discussed. The morphology, dynamics, luminosity, possible origins and composition of noctilucent clouds are then considered, as well as their existence on other planets. Experimental investigations are described. D.M.L.

N76-19643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO PROGRAM SUMMARY
John E. Jackson and James I. Vette Washington 1975 307 p refs
(NASA-SP-7601) Avail: NTIS HC $6.00 (special price) CSCL 04A

An overview of the OGO program is presented. Brief descriptions of the six OGO spacecraft, and the experiments on each are included. For individual titles, see N76-19644 through N76-19650.

N76-19644* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OVERVIEW OF THE OGO PROGRAM
In its OGO Program Summary 1975 27 p refs (For availability see N76-19643 10-46)
CSCL 04A

The objectives and background, approach and mission profiles are discussed along with the configuration, and accomplishments of the program. The results of experiments for OGO 1,2,3, and 4 are presented. F.O.S.

N76-19645* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT AND EXPERIMENT CHARACTERISTICS WITH LITERATURE REFERENCES
In its OGO Program Summary 1975 8 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 1 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with bibliographies of papers pertaining to that experiment. F.O.S.

N76-19646* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 2
In its OGO Program Summary 1975 7 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 2 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with a bibliography of papers pertaining to that experiment. F.O.S.

N76-19647* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 3
In its OGO Program Summary 1975 8 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 3 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with bibliographies of papers pertaining to these experiments. F.O.S.

N76-19648* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 4
In its OGO Program Summary 1975 8 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 4 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with bibliographies of papers pertaining to each experiment. F.O.S.

N76-19649* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 5
In its OGO Program Summary 1975 10 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 5 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with bibliographies of papers pertaining to each experiment. F.O.S.

N76-19650* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 6
In its OGO Program Summary 1975 9 p refs (For availability see N76-19643 10-46)
CSCL 04A

The OGO 6 spacecraft characteristics are briefly described. Brief descriptions of experiments are presented along with bibliographies of papers pertaining to each experiment. F.O.S.

N76-19651*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARACTERISTICS OF SOUTHERN HEMISPHERE 200 mb FLOW AS DETERMINED FROM SATELLITE DATA
Robert F. Adler Jan. 1976 27 p refs
(NASA-TM-X-71076; X-911-76-11) Avail: NTIS HC $4.00 CSCL 04A

Characteristics of Southern Hemisphere 200 mb flow are examined using geopotential height fields constructed with the aid of satellite based thermal structure. Similar Northern Hemisphere, satellite based fields are developed in order to make interhemispheric comparisons. Results indicate that both the zonal and meridional components of the S.H. eddy kinetic energy are as large as their N.H. counterparts. In winter the principal interhemispheric difference with respect to eddy kinetic energy is that the S.H. standing eddies are much less important only to the meridional component. Zonal component standing energy is about equal in the two hemispheres. In summer the S.H. has larger zonal eddy kinetic energy than the N.H. and smaller standing eddy contributions in both components. The meridional spectra show a preference for intermediate size transient waves. Author

N76-19652*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TERRESTRIAL KILOMETRIC RADIATION: 1: SPATIAL STRUCTURES STUDIES
J. K. Alexander and M. L. Kaiser Mar. 1976 40 p refs Submitted for publication
(NASA-TM-X-71081; X-693-76-47) Avail: NTIS HC $4.00 CSCL 04A

Observations are presented of lunar occultations of the earth at 250 kHz obtained with the Radio-Astronomy-Explorer-2 satellite which were used to derive two dimensional maps of the location of the sources of terrestrial kilometric radiation (TKR). By examining the two dimensional source distributions as a function of the observer's location (lunar orbit) with respect to the magnetosphere, the average three dimensional location of the emission regions can be estimated. Although TKR events at 250 kHz can often be observed at projected distances corresponding to the 250 kHz electron gyro or plasma level (approximately 2 earth radii), many events are observed much farther from the earth (between 5 and 15 earth radii). Dayside emission apparently in the region of the polar cusp and the magnetosheath and night emission associated with regions of the magnetotail are examined. The nightside emission is suggestive of a mechanism involving plasma sheet electron precipitation in the pre-midnight sector. Author

N76-19653*# Tennessee Univ. Space Inst., Tullahoma.
A STUDY OF SOME EFFECTS OF VERTICAL SHEAR ON THUNDERSTORMS
James Connell Washington NASA Jan. 1976 112 p refs (Contract NAS8-31197)
(NASA-CR-2647) Avail: NTIS HC $5.50 CSCL 04A

Evidence is presented for the existence of vortices and vortex pairs in thunderstorms. A preliminary parameterized model of the nonthermal generation of thunderstorm vortices derived from field observations of storms and laboratory observations of a jet in crossflow is reported, together with an explanation of how such a model might be used to guide analysis of mesoscale rawinsonde, radar, and satellite data toward an improved capability for prediction of thunderstorm motion and growth. Preliminary analyses of radar and satellite data from Atmospheric Variability Experiment IV are used with available rawinsonde data to develop a correlation between wind shears, instability, and thunderstorm motion and development. Specific studies are recommended for best development of concepts and utilization of data from Atmospheric Variability and Atmospheric Variability Severe Storms Experiments. Author

N76-19654# Royal Netherlands Meteorological Inst., De Bilt.
YEARBOOK B, NO. 121: GEOMAGNETISM. GEOMAGNETIC OBSERVATIONS AT WITTEVEEN, 1969
1975 48 p
(KNMI-98) Avail: NTIS HC $4.00; Roy. Neth. Meteorol. Inst. Dfl. 7.50

Data based on geomagnetic observations made by the Magnetic Observatory at Witteveen in the Netherlands during 1968 are tabulated. ESA

N76-19655# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
PHOTOCHEMICAL, DYNAMIC AND THERMODYNAMIC BEHAVIOR OF THE UPPER IONOSPHERE [DAS PHOTOCHEMISCHE, DYNAMISCHE UND THERMO DYNAMISCHE VERHALTEN DER OBEREN IONOSPHAERE]
Peter Stubbe Springer Verlag 1974 97 p refs In GERMAN
(Rept-52/1974; ISBN-3-540-07047-8) Avail: NTIS HC $5.00

The theory on the actual state of the upper ionosphere is reviewed and compared with experimental parameters. A computer program was set up for solving the continuity equations of O+, NO+, O2+, N2+, H+, He+ and N+ ions, the equations of motion of ions and neutral gas, and ion and electron energy equations. From the results, altitude profiles of ion and electron density velocity, temperature and horizontal component of wind velocity were plotted for different hours. A revised ionospheric model was derived. ESA

N76-19656# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
THERMOSPHERIC WINDS AND THEIR INFLUENCE ON THE IONOSPHERE (REVIEW)
R. Ruester Springer Verlag 1974 27 p refs
(Rept-53/1974; ISBN-3-540-07070-2) Avail: NTIS HC $4.00

New results of observations and theoretical calculations of thermospheric winds in the upper atmosphere above 150 km are presented. The effects of the winds on the ionospheric F2-layer are considered in some detail. Many features of the F-layer behavior at middle and high latitudes during magnetically quiet conditions can be explained in terms of calculated winds using standard atmospheric models. At lower latitudes, however, calculations using model winds have not been successful in explaining the observed F-layer behavior. Special investigations using atmospheric models which take into account a variation of atmospheric composition and temperature during different seasons and increased geomagnetic activity were carried out. Thermospheric winds resulting from these models and their influence on the ionosphere are discussed. Author (ESA)

N76-19657# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
LOCALIZATION OF Pc1
F. Glangeaud and J. L. Lacoume 25 Sep. 1975 18 p refs Presented at the 16th Intern. Union of Geodesy and Geophys. Gen. Assembly, Grenoble, France, 1975
(CEPHAG-41/75) Avail: NTIS HC $3.50

Longitudinal survey of Pc1 was performed in January and February 1975. A comparison of the time of arrival of Pc1, by means of the cross correlation technique was carried out. A few preliminary results of time delay at geomagnetic latitude 60 deg are presented. A comparison of these time delays and other measurements was made in order to localize the line of force where these Pc1 will be found. Some Pc1 move with the particles; others remain at the same longitude. A discussion of the methods and the results are given. Author (ESA)

N76-19658# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA Data Summary, Jan.-Mar. 1975
G. Gustafsson, ed. Mar. 1975 68 p
(Rept-75/1-3) Avail: NTIS HC $4.50

The data obtained from ground measurements relate to polar upper atmospheric conditions and include measurements of geomagnetism, optical aurora, ionospheric ionization, radio wave propagation, and cosmic radiation. ESA

N76-19659# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA Data Summary, Apr.-Jun. 1975
G. Gustafsson, ed. Jun. 1975 66 p
(Rept-75/4-6) Avail: NTIS HC $4.50

The data obtained from ground measurements relate to polar upper atmospheric conditions and include measurements of geomagnetism, optical aurora, ionospheric ionization, radio wave propagation, and cosmic radiation. ESA

N76-19660# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
NEAR-FIELD SMALL EARTHQUAKE STRONG MOTION STUDIES Final Semiannual Technical Report, 1 Feb. - 31 Jul. 1975
Mihailo D. Trifunac 31 Jul. 1975 23 p refs
(Contract F44620-72-C-0097; ARPA Order 2134)
(AD-A016059; AFOSR-75-1365TR) Avail: NTIS CSCL 08/11

The ability to distinguish between the explosive and tectonic energy releases in the magnitude range 3 less than or equal to M less than or equal to 5 is examined. Recording the near-field strong ground motion helps in more accurate determinations of the earthquake source time function and improves the reliability of the near- and far-field spectra which are still the basic tools in detection work. Author

N76-19661# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
THEORETICAL INVESTIGATION OF ELECTRICAL RESISTIVITY AND STRENGTH IN SITU Final Report, 1 Jan. 1974 - 31 Apr. 1975
J. B. Walsh 31 Mar. 1975 38 p refs
(Contract F19628-74-C-0139; AF Proj. 7639; DNA Proj. NWED-QAXSB101)

(AD-A015829; AFCRL-TR-75-0350) Avail: NTIS CSCL 08/7

Strength and electrical resistivity in situ are probably not strongly related. Strength depends upon the lengths of cracks in the formation, and therefore it is sensitive to the presence of joints or faults. Expressions for the effect of cracks upon electrical resistivity are derived here by assuming they are penny-shaped ellipsoids isolated in an infinite matrix or as thin films running through the sample. The expressions suggest that resistivity depends upon porosity rather than crack length, and that joints probably do not affect the overall electrical characteristics of a formation appreciably. GRA

N76-19662# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.

PATTERN ANALYSIS AND CLASSIFICATION WITH THE NEW ACDA SEISMIC SIGNATURE DATA BASE Interim Report

C. H. Chen and I. Chang Lin 12 Aug. 1975 110 p refs

(Grant AF-AFOSR-2119-71; AF Proj. 9769)

(AD-A015925; AFOSR-75-1296TR) Avail: NTIS CSCL 08/11

The new and expanded ACDA seismic data base makes it possible for meaningful comparison of different seismic recognition techniques based on the same data set. There are 157 earthquake and 157 explosion records in the data base. Pattern analysis in frequency domain as well as two-dimensional space is performed to seek for classification clues. Although useful structure of the seismic records is not available, the mathematical features provided by the autocorrelation function have 86.36% correct recognition on testing set by using 3 features (autocorrelation coefficients), 80 selected good quality training samples per class and the nearest-neighbor decision rule. All samples in the training set are identified correctly and thus the overall recognition rate of 93.00% is achieved. This result is better than the 89.2% recognition using dynamic spectral ratios (Table 7). The autocorrelation coefficients which are simple to calculate also perform better than the linear predictor (Markel) coefficients and other discriminants. GRA

N76-19663# Teledyne Geotechnical, Garland, Tex.

DEEP BOREHOLE OPERATION OF THE BOREHOLE SEISMOMETER SYSTEM, MODEL 36000 Special Technical Report, Aug. 1973 - Jan. 1975

E. J. Douze and John R. Sherwin 15 Mar. 1973 109 p refs

(Contract F08606-74-C-0013)

(AD-A015849; TR-75-2) Avail: NTIS CSCL 08/11

The project described was concerned primarily with, first, the modification of the Borehole Seismograph System, Model 36000, to operate under the high pressure and high temperature environment encountered in boreholes up to 3000 m (10,000 ft) deep, and secondly, various studies of signals and noise as a function of depth. Modification of the instrument, along with required auxiliary equipment was relatively straightforward and consisted primarily of substitution of high-reliability, 105C components for some of the standard units in the electronics sections. Actual operations were carried out at a deep borehole site near Pinedale, Wyoming during the period from April through December 1974. Data from three different long-period (LP) seismographs were recorded for analysis - a conventional surface LP system using 10 kg mass seismometers and galvanometer-phototube amplifiers, a standard Model 36000 at a fixed depth of 46 m (150 ft) and a deep-hole Model 36000 at various depths from 46 m to 914 m (3000 ft). GRA

N76-19664# Radiation Research Associates, Inc., Fort Worth, Tex.

SKY RADIANCE CALCULATIONS IN THE 0.5 MICROMETER: 5.0 MICROMETER WAVELENGTH RANGE Final Report, 1 Feb. 1974 - 30 Apr. 1975

Wolfram G. M. Blattner and Michael B. Wells 31 May 1975 189 p refs

(Contract F19628-74-C-0140; DNA Proj. NWED-AAXYX966)

(AD-A015812; RRA-T7501; AFCRL-TR-75-0317) Avail: NTIS CSCL 04/1

The FLASH Monte Carlo code was modified in order to allow for the atmospheric emission and for the emission by the surface of the earth. The modification includes the consideration of the newest absorption data available. The FLASH program was then used for calculations of the radiances obtained for air-borne detectors at 120, 200, and 35,800 km altitudes. GRA

N76-19665# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.

DATA SYSTEM DEVELOPED FOR PROJECT ICE CAP 1974 Scientific Interim Report

Dennis E. Delorey and Paul N. Pruneau L. G. Hanscom Field, Mass. AFCRL Dec. 1974 105 p

(Contract F19628-73-C-0133)

(AD-A017406; AFCRL-TR-75-0303) Avail: NTIS CSCL 04/1

This report summarizes the overall data system developed to process rocket data from project ICE CAP '74. Overall data flow and management procedures are described. Computer routines, written in modular fashion, are also described. Applications in the form of processing requirements are elaborated upon and data bases are defined. GRA

N76-19666# Pittsburgh Univ., Pa.

ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS Final Report, 26 Apr. 1966 - 30 Jun. 1975

Manfred A. Biondi 11 Sep. 1975 16 p refs

(Contract DA-31-124-ARO(D)-440; ARPA Order 826)

(AD-A017206) Avail: NTIS CSCL 04/1

The research topics carried out under this ten year contract are stated and references are given to the publications of the scientific findings resulting from the research. GRA

N76-19667# Regis Coll., Weston, Mass.

GEOPOLE OBSERVATORY DATA, 1 JULY 1974 - 30 JUNE 1975 AND WINTER SEASON SPECIAL EVENT DATA 1973-1974 AND 1974-1975 Interim Report

D. F. Korff 24 Sep. 1975 64 p

(Contract F19628-73-C-0259; AF Proj. 7663)

(AD-A017603; AFCRL-TR-75-0501; SR-1) Avail: NTIS CSCL 04/1

A summary of VLF, magnetometer, riometer and 5577A photometer ten-minute averaged data from the Geopole Observatory, Thule, Greenland for the period 1 July 74 - 30 June 75 is presented along with a 30-second data survey for the same sensors of energetic particle and magnetic disturbance events for the winter seasons of 1973-1974 and 1974-1975. The occurrence of these events in relation to the interplanetary magnetic field sector structure is discussed. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-19668 California Univ., Los Angeles.

STUDY OF MICRO- AND MACRO-PHYSICAL PROPERTIES OF CUMULUS CLOUDS Ph.D. Thesis

In Young Lee 1975 131 p

Avail: Univ. Microfilms Order No. 76-5121

A cumulus cloud model was developed in order to study the interaction between the microphysical processes and the dynamic structures and to see the influence of changes in the environment on the cloud development. The time dependent cumulus cloud model consists of cloudy and clear regions. In the model, the cloudy air modifies the environmental air characteristics and vice versa, and both lateral eddy mixing and dynamic entrainment of air variables are included. In describing the microphysical processes, both the condensational and the collectional growth mechanisms are considered. In general, the cloud parameters computed by the model agree with the typical values measured in the cumulus clouds. However, the constant environmental air characteristics result in longer cloud life and in larger values of cloud parameters, since the adiabatic heating due to the downward motion in environment is not considered and the lateral eddy mixing makes a smaller contribution to the dynamic processes. Dissert. Abstr.

N76-19669 Georgia Univ., Athens.
ESTIMATION OF 1-HOUR TIMELAG FUEL MOISTURE WITH SURFACE AND SYNCHRONOUS METEOROLOGICAL SATELLITE DATA Ph.D. Thesis
Marshall Pope Waters, III 1975 176 p
Avail: Univ. Microfilms Order No. 76-6457

Synchronous meteorological satellite visual and infrared spin scan radiometer data were analyzed quantitatively for cloud cover and surface temperature for an area in the southeastern United States for 5 days in January 1975. Surface measures of air temperature and humidity at National Weather Service and military observation stations within the study area augmented the satellite data. The 1-hour timelag fuel moisture component of fuel model D in the National Fire Danger Rating System was estimated by: (1) using the satellite visual information for cloud cover, (2) air temperature blended with surface equivalent black body temperatures, and (3) an estimate of humidity made from ground stations. This automated estimate of 1-hour timelag fuel moisture was compared with measured values taken at Fire Danger Stations located in the study area. Dissert. Abstr.

N76-19670*# Kanner (Leo) Associates, Redwood City, Calif.
POSSIBILITY OF IDENTIFICATION OF PRECIPITATION FROM MICROWAVE MEASUREMENTS MADE FROM SATELLITE
Ye. P. Dombkovskaya and V. V. Ozerkina Washington NASA Mar. 1976 16 p refs Transl. into ENGLISH from Trudy no. 165, Hydrometeorol. Sci. Res. Center USSR (Leningrad), 1975 p 77-86
(Contract NASw-2790)
(NASA-TT-F-16929) Avail: NTIS HC $3.50 CSCL 04B

The possibility of identifying various types and intensities of precipitation by satellite microwave measurements is examined. Formulas are presented for calculating thermal radio emission which allow for atmospheric attenuation. Methods are shown by which various low- and high-intensity rains and cloud formations can be identified by measurements made at several wavelengths with the aid of a special nomogram and tabulated data. The use of single-wavelength (0.8-cm) measurements involving horizontal and vertical polarization is also discussed, as is the identification of frontal conditions with the aid of brightness temperature profiles. Author

N76-19671*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC ENVIRONMENT FOR ASTP (SA-210) LAUNCH
D. L. Johnson Feb. 1976 33 p refs
(NASA-TM-X-64990) Avail: NTIS HC $4.00 CSCL 04B

A summary is presented of selected atmospheric conditions observed near ASTP/SA-210 launch time on July 15, 1975, at Kennedy Space Center, Florida. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), density, index of refraction, and wind/wind shear aloft are included. A final meteorological data tape for the ASTP launch, consisting of wind and thermodynamic parameters versus altitude, has been constructed. Author

N76-19672*# Transemantics, Inc., Washington, D.C.
CERTAIN CHARACTERISTICS OF THE VERTICAL STRUCTURE OF THE AREA OF MOISTURE DURING VARIOUS PRECIPITATIONS
Ye. P. Dombkovskaya, M. V. Bobrova, and V. V. Ozerkina NASA Mar. 1976 18 p refs Transl. into ENGLISH from Tr. no. 148, Hydrometeorol. Sci. Res. Center (Leningrad), 1974 p 102-114
(Contract NASw-2792)
(NASA-TT-F-16935) Avail: NTIS HC $3.50 CSCL 04B

Weather ships stationed in the North Atlantic were used to study the vertical structure of the humidity field. The humidity field was studied both in clear and cloudy weather. Cloudy weather accompanied by drizzle, steady rain, and downpours was chosen for the investigation. Author

N76-19673*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR NASA's AVE 4 EXPERIMENT: 25 mb SOUNDING DATA AND SYNOPTIC CHARTS
Nancy F. Fucik (Texas A and M Univ., College Station) and Robert E. Turner Washington Mar. 1976 56 p refs Document includes a Microfiche supplement
(Contract NAS8-26751)
(NASA-TN-D-8161; M164) Avail: NTIS HC $4.50 CSCL 04B

The AVE IV Experiment is described and tabulated rawinsonde data at 25 mb intervals from the surface to 25 mb for the 42 stations participating in the experiment are presented. Soundings were taken between 0000 GMT, April 24, and 1,200 GMT, April 25, 1975. The methods of data processing and accuracy are briefly discussed. Synoptic charts prepared from the data are presented, as well as an example of contact data. Author

N76-19674*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR NASA's AVSSE 2 EXPERIMENT: 25 mb SOUNDING DATA AND SYNOPTIC CHARTS
Nancy F. Fucik (Texas A and M Univ., College Station) and Robert E. Turner Washington Mar. 1976 24 p refs Document includes a Microfiche supplement
(Contract NAS8-26751)
(NASA-TN-D-8154; M162) Avail: NTIS HC $3.50 CSCL 04B

The AVSSE II experiment is described and tabulated rawinsonde data at 25 mb intervals from the surface to 25 mb for the 23 stations participating in the experiment are presented. Soundings were taken between 1,200 GMT, May 6, and 1,200 GMT, May 7, 1975. The methods of data processing and accuracy are briefly discussed. Synoptic charts prepared from the data are presented, as well as an example of contact data. Author

N76-19675# World Meteorological Organization, Geneva (Switzerland).
THE PHYSICAL BASIS OF CLIMATE AND CLIMATE MODELLING Global Atmospheric Research Program
Apr. 1975 289 p refs Proc. of the WMO/ICSU Intern. Study Conf. Stockholm, 29 Jul. - 10 Aug. 1974; sponsored by UN Environ. Program Prepared jointly with ICSU
(GARP-Publ-16) Avail: NTIS HC $9.25; WMO, Geneva

An introduction to climatic modelling and its place in global research is given followed by a general conference recommendation. The observed variability of the climatic system is reviewed. Basic principles of climatic modelling are described and the experimental design of climate models and their use in sensitivity and predictability studies is discussed. Physical, chemical and biological processes to be included in climate models are outlined in detail and the observing program required to implement studies recommended is described. Position papers presented to the conference are contained in appendices. For individual titles, see N76-19676 through N76-19696.

N76-19676 National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.
ON THE VARIABILITY OF THE GENERAL CIRCULATION OF THE ATMOSPHERE AS DEDUCED FROM AEROLOGICAL DATA
Abraham H. Oort *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 96-105 refs (For availability see N76-19675 10-47)
Copyright.

In an effort to understand the earth's climate, using available upper air data, recent comprehensive climate programs are reviewed. The present knowledge of climatic variability and results of earlier climate programs are discussed with examples. Suppositions for a climate monitoring program are made and the limitations in the planned data set considered. ESA

N76-19677 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
HISTORY AND INTRANSITIVITY OF CLIMATE
H. Flohn *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 106-118 refs (For availability see N76-19675 10-47)
Copyright.

Observed climatic fluctuations during the period of instrumental records cannot be taken as indicators of an almost-intransitive

climate: evidence for this exists only on a much longer time scale. However, the occurrence of bimodal frequency distributions of meteorological data indicates local or regional instabilities of climate. Climatic anomalies demonstrating such instabilities are described. The time scale of climatic fluctuations is discussed together with various historical events occurring in the anomalous periods. Extreme climatic patterns during the past 100,000 years are reviewed and an appendix on the energetics of global climatic changes is added. ESA

N76-19678 Wisconsin Univ., Madison.
DIAGNOSTIC STUDIES OF PAST CLIMATES
J. E. Kutzbach *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 119-126 refs (For availability see N76-19675 10-47)
Copyright.

The potential usefulness of paleo-environmental sensors for the study of the climate of the last 2 million years is described. Four inter-related objectives of a program for theory of research on past climates are listed and the requirements of a basic data set for past climates are noted. Diagnostic studies of past climatic fluctuations are presented with examples from the point of view of time scale. ESA

N76-19679 National Oceanic and Atmospheric Administration, Silver Spring, Md. National Weather Service.
NOTE ON SOLAR VARIABILITY AND VOLCANIC ACTIVITY AS POTENTIAL SOURCES OF CLIMATIC VARIABILITY
J. M. Mitchell, Jr. *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 127-131 refs (For availability see N76-19675 10-47)
Copyright.

The origins of all climatic variability are briefly noted and the role played by solar variability and volcanic activity in climatic fluctuations and variability on short time scales is discussed. Inadequacies that exist in the fundamental understanding of the nature and extent of environmental variability in these two respects, as they may relate to the problem of climate variability and climate predictability are stressed. ESA

N76-19680 Massachusetts Inst. of Tech., Cambridge.
CLIMATIC PREDICTABILITY
Edward N. Lorenz *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 132-136 refs (For availability see N76-19675 10-47)
Copyright.

A distinction is drawn between climatic predictions that are directly concerned with the chronological order in which atmospheric states occur and those which are not. Following a brief review of what is known about the predictability of weather, basic features of the two kinds of climate predictability are described and the difficulties in establishing the differences between the ensembles of weather patterns are noted. Transitive, intransitive, and almost intransitive climates are defined and the latter discussed in detail. Conclusions are drawn as to the most suitable models to use in studying climatic predictability. ESA

N76-19681 National Center for Atmospheric Research, Boulder, Colo.
THE DESIGN OF STATISTICAL-DYNAMICAL CLIMATE MODEL AND STATISTICAL CONSTRAINTS ON THE PREDICTABILITY OF CLIMATE
C. E. Leith *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 137-141 (For availability see N76-19675 10-47)
Copyright.

A prescription for the design of a climate model which combines an internal statistical and an external dynamical component is presented. The theoretical basis for making such a separation is a somewhat special definition of climate which is discussed at some length. The external dynamic model is like traditional circulation models in using deterministic equations; the internal statistical model, however, is based on statistical hydrodynamical equations for the evolution of statistical moments. The logical statistical consequence of the well-known limited predictability of weather as it relates to the predictability of climate is also discussed. The problem is described in terms of a signal of possibly predictable climate change as compared to the noise coming from unpredictable weather fluctuations. ESA

N76-19682 National Center for Atmospheric Research, Boulder, Colo.
CLIMATE MODELLING METHODOLOGY
Stephen H. Schneider and Robert E. Dickinson *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 142-147 refs (For availability see N76-19675 10-47)
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A hierarchy of climate models, based on the number of geometric degrees of freedom contained in the model rather than its mechanistic or simulation characteristics, is reviewed. Included are horizontally averaged, one-dimensional vertical coordinate models; horizontally varying energy balance models; zonally symmetric dynamic atmospheric models; atmospheric dynamic models emphasizing longitudinal variation; zonally symmetric models of the earth-atmosphere system; three-dimensional circulation models of the atmosphere and three-dimensional circulation models of the earth-atmosphere system. The development of future climate models is also briefly considered. ESA

N76-19683 National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.
THE USE OF COMPREHENSIVE GENERAL CIRCULATION MODELLING FOR STUDIES OF THE CLIMATE AND CLIMATE VARIATION
S. Manabe *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 148-162 refs (For availability see N76-19675 10-47)
Copyright.

Comprehensive climate models in contrast to statistical-dynamical models are first defined followed by a summary of the present status of climate simulation by atmospheric and earth-atmosphere models. Possible causes of climatic changes are listed from both external and internal viewpoints. Use of a comprehensive climate model for evaluating the relative importance of the various possible causes of the climatic changes is discussed, taking as an example a sensitivity study of the effects of doubling carbon dioxide concentration in the atmosphere. Joint ocean-atmosphere models are considered in relation to climate prediction and recommendations are made with respect to comprehensive models of climate. ESA

N76-19684 Universidad Nacional Autonoma de Mexico, Villa Obregon. Inst. de Geofisica.
A CRITICAL APPRAISAL OF SIMPLE CLIMATIC MODELS
Julian Adem *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 163-170 refs (For availability see N76-19675 10-47)
Copyright.

Simple models of climate are first defined followed by a brief description of a model which computes equilibrium temperatures in the atmosphere-ocean-continent system corresponding to the balance of heating and transport components of the system. Other simple models using thermodynamic energy equations and time averaging are critically assessed and numerical experiments with the various models are described. ESA

N76-19685 Massachusetts Inst. of Tech., Cambridge.
DYNAMICS OF DESERTS AND DROUGHT IN THE SAHEL
J. Charney *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 171-176 refs (For availability see N76-19675 10-47)
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The construction of a simple mathematical model of the flow over the Sahara is described. The flow is assumed to be zonally symmetric and bounded to the sand by a fixed ITCZ at which the temperature is specified. Recent numerical modelling results relating to the Sahel desert are presented. The hypothesis that the desert-monsoon circulation in the Sahara is nearly self-contained and that the drought caused in part by over-grazing and causing changes in albedo is advanced and tested by a simulation experiment with a general circulation model. Preliminary results confirm the hypothesis. ESA

N76-19686 Oxford Univ. (England).
MODELLING OF ATMOSPHERIC RADIATION FOR CLIMATIC STUDIES
C. D. Rodgers *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 177-180 refs (For availability see N76-19675 10-47)
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The major parameters which determine the distribution of atmospheric radiation in General Circulation Models (GCM) are listed in order of importance, and the calculation of radiation is discussed. The two types of radiation - solar and terrestrial - active in atmospheric radiaton transfer processes are described and radiation transfer models in general are discussed. ESA

N76-19687 Wisconsin Univ., Madison.
A PROPOSED RADIATION PARAMETERIZATION SCHEME FOR CLIMATE MODELS
V. E. Suomi *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 181-182 refs (For availability see N76-19675 10-47)
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The approach to radiation parameterization is discussed and results of schemes summarized. A new scheme is proposed where radiation and other atmospheric parameters - temperature, moisture, motion and cloud field - are measured together. The benefits of a successful parameterization scheme for climatic modelling are noted. ESA

N76-19688 California Univ., Los Angeles.
MODELLING CLOUDS AND CLOUD PROCESSES FOR USE IN CLIMATE MODELS
Akio Arakawa *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 183-197 refs (For availability see N76-19675 10-47)
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The ways in which clouds and their associated physical processes influence the climate are enumerated and the difficulties in modelling clouds expounded. Observations of large-scale cloud systems over the sub-tropical and tropical oceans showing regional differences in cloud regimes are summarized. These show that the Planetary Boundary Layer (PBL) tends to be well-mixed and inversion-capped. An approach to modelling the PBL is presented, consideration being given to boundary layer stratiform clouds and meso-scale cellular convection. The importance of deep cumuliform clouds in coupling mechanisms is considered. A review of the Arakawa-Schubert theory of cumulus cloud interactions with the large-scale environment is given and compared with earlier parameterization schemes and observations. ESA

N76-19689 Uppsala Univ. (Sweden).
PROPERTIES OF LAND SURFACES AND THEIR INFLUENCE ON ATMOSPHERIC PROCESSES
Erik Eriksson *In* WMO The Phys. Basis of Climate and Climate modelling Apr. 1975 p 198-200 (For availability see N76-19675 10-47)
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The interaction between the atmosphere and land surfaces are related to three processes - momentum, energy and matter fluxes. The parameters by which these fluxes are set are described. From this it is clear that the geographical distribution of surface properties of various kinds must be taken into account and brought into atmospheric models. Relevant properties - surface roughness, surface reflectivity, heat and water storage capacity and water runoff - and their probable relation to geographical features, in particular vegetation cover, are discussed. ESA

N76-19690 Academy of Sciences (USSR), Moscow. P. P. Shirshov Inst. of Oceanology.
THE ROLE OF THE OCEANS IN CLIMATIC MODELS
A. S. Monin *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 201-205 refs (For availability see N76-19675 10-47)
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The ocean as a necessary element of any climatic model is considered. Both small- and large-scale air sea interactions are described and their importance in understanding climate genesis and oscillations is stressed. Parameterization and modelling of air sea interactions are discussed together with climate modelling. ESA

N76-19691 Washington Univ., Seattle.
SEA ICE AND ICE SHEETS AND THEIR ROLE IN CLIMATIC VARIATIONS
N. Untersteiner *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 206-224 refs (For availability see N76-19675 10-47)
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The five categories into which the terrestrial cryosphere can be divided - seasonal snow, permafrost, mountain glaciers, sea ice and continental ice sheets - are reviewed and their effect on climatic change discussed. A brief summary of present knowledge of the properties, formation, growth and dynamics of sea ice is presented. The requirements of ice sheet models are stated and their significance for world climate is noted with special reference to the Greenland and Antarctic ice sheets. A list of desirable GARP research projects focussing on physical processes in sea ice and ice sheets is given. ESA

N76-19692 Stockholm Univ. (Sweden). Inst. of Meteorology.
A CRITICAL APPRAISAL OF MODELS FOR THE CARBON CYCLE
Bert Bolin *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 225-235 refs (For availability see N76-19675 10-47)
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A survey of the carbon cycle in nature is given, followed by a brief qualitative description of the basic observed characteristics that any model development for its quantitative description must include. Comments are made on changes in the carbon cycle due to such changes as ocean circulation, different rates of photosynthesis due to other climatic conditions and interplay with bottom sediments. A brief account of the box model concept with the assumption of well-mixed reservoirs is given together with an analysis of the limitations of such simple models. Key problems - notably that of the role of deep sea circulation - are discussed. ESA

N76-19693 National Center for Atmospheric Research, Boulder, Colo.
PHYSICAL AND CHEMICAL PROCESSES WHICH CONTROL THE PRODUCTION, DESTRUCTION AND DISTRIBUTION OF OZONE AND SOME OTHER CHEMICALLY ACTIVE MINOR CONSTITUENTS
P. J. Crutzen *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 236-243 refs (For availability see N76-19675 10-47)
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The chemistry of atmospheric ozone and a number of other gaseous constituents which are important for the distribution and abundance of ozone in the atmosphere is reviewed. Stratospheric chemistry is discussed together with man's impact on the ozone layer. A list and short discussion of the gas phase reactions considered to be of relevance for the modelling of chemical processes, especially in the stratosphere are given. Compounds not influenced by heterogeneous reactions are described followed by a discussion of heterogeneous reactions in the troposphere. ESA

N76-19694 Max-Planck-Institut fuer Chemie, Mainz (West Germany).
THE POSSIBLE INFLUENCE OF AEROSOLS ON THE GENERAL CIRCULATION AND CLIMATE AND POSSIBLE APPROACHES FOR MODELLING
Christian E. Junge *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 244-251 refs (For availability see N76-19675 10-47)
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The possible mechanisms by which atmospheric aerosols may give rise to long term effects on the general circulation and climate are discussed. The general situation is reviewed by comparing the aerosols with another climatically important constituent, carbon dioxide. How the various effects of tropospheric and stratospheric aerosols on climate can be modelled in terms of the strength of their various sources is also discussed. ESA

N76-19695 Cologne Univ. (West Germany).
SATELLITE CAPABILITY IN MONITORING CLIMATE PARAMETERS
Ehrhard Raschke *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 252-257 refs (For availability see N76-19675 10-47)
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The ways in which satellites can collect data are briefly reviewed followed by orbital considerations. Climatic values are dependent on radiation measurements and aspects of the interaction of radiation and matter are discussed together with the constraints imposed on monitoring climatic values from satellites. The radiation budget of the earth-atmosphere system is noted and climatic parameters at the ground and in the atmosphere are discussed. ESA

N76-19696 Atmospheric Environment Service, Toronto (Ontario).
GLOBAL ATMOSPHERIC MONITORING SYSTEMS
R. E. Munn *In* WMO The Phys. Basis of Climate and Climate Modelling Apr. 1975 p 258-265 refs (For availability see N76-19675 10-47)
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Principles that should be considered in the design of monitoring systems are reviewed followed by a description of existing and planned global atmospheric monitoring systems. These include the WMO World Weather Watch, the WMO Climate Network, the WMO World Radiation Network, the World Data Centers, the WMO Regional and Baseline Air Chemistry Networks, and the Global Environmental Monitoring System. ESA

N76-19697# World Meteorological Organization, Geneva (Switzerland).
LONG-TERM CLIMATIC FLUCTUATIONS
1975 515 p refs Proc. of a Symp. held at Norwich, Ontario, 18-23 Aug. 1975; sponsored by Intern. Assoc. of Meteorology and Atmospheric Phys.
(WMO-421) Avail: NTIS HC $12.75; WMO, Geneva

The following broad subject areas are covered: global paleoclimatic chronology; stable isotopes - studies of the last glaciation and since; holocene and recent events; patterns of climatic change; statistical properties of climatic change; theory of climate and climatic change; numerical modeling of climatic change; climate predictability and the future; and impact of man and the international economy of current and future climatic changes. For individual titles, see N76-19698 through N76-19753.

N76-19698 Amsterdam Univ. (Netherlands). Hugo de Vries Lab.
PALYNOLOGY AND PALAEOCLIMATOLOGY OF THE LAST 100,000 YEARS
T. A. Wijmstra *In* WMO Long-term Climatic Fluctuations 1975 p 5-20 refs (For availability see N76-19697 10-47)
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The nature of pollen is described followed by a discussion of methods of transferring floristic data into climatological parameters. Using the diagrams, three examples of changes in the overall vegetation cover during the last 100,000 years brought about by changes in the global climate are discussed. ESA

N76-19699 Arizona Univ., Tucson. Lab. of Tree-ring Research.
POTENTIAL OF TREE RINGS FOR RECONSTRUCTION OF PAST CLIMATE VARIATIONS IN THE SOUTHERN HEMISPHERE
Valmore C. LaMarche, Jr. *In* WMO Long-term Climatic Fluctuations 1975 p 21-30 refs (For availability see N76-19697 10-47)
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The role of the Southern Hemisphere in global climatic variation is discussed and the need for paleoclimatic data to understand transhemispheric relationships and interactions is stressed. The annual rings of trees as a source of paleoclimatic information are considered, various types of rings are described and their advantages noted. The dendroclimatic potential of the Southern Hemisphere is discussed especially in relation to precipitation and its effect on tree growth. ESA

N76-19700 Tsukuba Univ. (Japan).
WIND VARIATION IN THE LOWER TROPOSPHERE OVER JAPAN IN THE LATE QUATERNARY PERIOD ESTIMATED BY THE DISTRIBUTION OF VOLCANIC ASHES
M. M. Yoshino and H. Tabuchi (Hosei Univ.) *In* WMO Long-term Climatic Fluctuations 1975 p 31-38 refs (For availability see N76-19697 10-47)
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The distribution of volcanic ashes as an indicator of climatic wind conditions is discussed together with the main problems. The relationship between the shape of the ash, deposit area and the upper winds is studied and the shape index in Japanese historical and geological periods is given, revealing that the climate was warmer when the westerly wind velocity in the lower troposphere was higher. ESA

N76-19701 Australian National Univ., Canberra. Dept. of Biogeography and Geomorphology.
LATE QUATERNARY CLIMATES OF AUSTRALIA AND NEW GUINEA: A SUMMARY
J. M. Bowler, G. S. Hope, J. N. Jennings, G. Singh, and D. Walker *In* WMO Long-term Climatic Fluctuations 1975 p 39-46 (For availability see N76-19697 10-47)
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A summary of a synthesis of published and unpublished studies of late quaternary environments in Australia and New Guinea covering the last decade and a half is given. The evidence is approached climatologically, first for New Guinea and northen Australia on the equatorial side of the desert, secondly for the southern part of the continent dominated by western circulation. Finally, regional correlations and broader complications are discussed. ESA

N76-19702 Goteborg Univ. (Sweden). Lab. of Marine Geology.
ON THE COURSE OF A GLACIAL AGE
Eric Olausson *In* WMO Long-term Climatic Fluctuations 1975 p 47-52 refs (For availability see N76-19697 10-47)
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Aspects on the course of a glacial age and on the hydrography of the North Atlantic during temperature minimum are given. Changes in the past of the Somali Current and position changes in the boundary between the Gulf Stream water mass and the Subarctic water mass are discussed together with changes in the vertical circulation and calcium carbonate distribution of the oceans. ESA

N76-19703* Lamont-Doherty Geological Observatory, Palisades, N.Y.
THE EVOLUTION OF CLIMATE
William L. Donn and David Shaw (Brooklyn Coll.) *In* WMO Long-term Climatic Fluctuations 1975 p 53-64 refs Sponsored in part by U.S. Steel Found. and NASA Prepared jointly with City Univ. of New York (For availability see N76-19697 10-47)
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A quantitative evaluation is made of the climatic effects of polar wandering plus continental drift in order to determine wether this mechanism alone could explain the deterioration of climate that occurred from the warmth of Mesozoic time to the ice age conditions of the late Cenozoic. By way of procedure, to investigate the effect of the changing geography of the past on climate Adem's thermodynamic model was selected. The application of the model is discussed and preliminary results are given. ESA

N76-19704 Louvain Univ. (Belgium). Lab. of Meteorological Research.
THE ASTRONOMICAL THEORY OF PALEOCLIMATES: A CASCADE OF ACCURACY
A. L. Berger *In* WMO Long-term Climatic Fluctuations 1975 p 65-72 refs (For availability see N76-19697 10-47)
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The determination of the mathematical paleoclimate which is defined as a generalization of the restricted astronomical theory of Milankovitch is composed of three successive parts: computation of insolations, determination of the long period variations of the ecliptic elements and modeling of climate modeling. The order of magnitude of the accuracy peculiar to each point of the sequential analysis and its consequential effects upon the

following steps is discussed. The most accurate solution is obtained for the insolation and astronomical elements. ESA

N76-19705 Lamont-Doherty Geological Observatory, Palisades, N.Y.
THERMAL AND OCEANIC STRUCTURES OF THE ATLANTIC THROUGH A GLACIAL-INTERGLACIAL CYCLE c48
Andrew McIntyre, A. W. H. Be, James D. Hays, James V. Gardner, Jose A. Lozano, Barbara Molfino, Warren Prell, Hans R. Thierstein, Thomas Crowley (Brown Univ.), John Imbrie (Brown Univ.) et al *In* WMO Long-term Climatic Fluctuations 1975 p 75-80 refs (For availability see N76-19697 10-47)
(Grants NSF IDO-71-04204-A04E; NSF DES-73-00467-A01)
Copyright.

The central mission of the CLIMAP Project of the International Decade of Ocean Exploration is briefly described and the steps involved in paleo-oceanographic reconstruction outlined. The reconstruction takes two forms: distributional maps of oceanographic parameters at a finite time in the past and transects in time and space delineating the change in geometry and rate-of-change of these parameters. An example of each form is described to depict the paleo-oceanographic history of the Atlantic Ocean. ESA

N76-19706 California Univ., Los Angeles. School of Engineering.
HISTORIC WEATHER RECORDS IN STABLE ISOTOPE RATIOS OF TREE RINGS
L. J. Pandolfi, P. H. Payton, M. G. Weiler, and L. M. Libby *In* WMO Long-term Climatic Fluctuations 1975 p 83-85 refs (For availability see N76-19697 10-47)
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Measurements of stable oxygen isotope ratios in oak tree rings in Europe and Sugi tree rings in Japan and their correlation with climatic temperature changes are described. ESA

N76-19707 Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
THE LAURENTIDE ICE SHEET: PROBLEMS OF THE MODE AND SPEED OF INCEPTION
J. T. Andrews, R. G. Barry, P. T. Davis, A. S. Dyke, M. Mahaffy, L. D. Williams, and C. Wright *In* WMO Long-term Climatic Fluctuations 1975 p 87-94 refs (For availability see N76-19697 10-47)
(Grant NSF GA-40248)
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The growth rate and development of the Laurentide Ice Sheet are briefly described followed by a discussion of the extent of late Neoglacial snow cover over northern Baffin Island as an example of an 'abortive' glaciation. The change in snowline between the present day and the late Neoglacial era as an indication of the sensitivity of the upland plateaux of the eastern Canadian Arctic to small-scale climatic shifts is discussed. The use of a three-dimensional numerical ice flow model to conduct an experiment on the growth rate of the Laurentide Ice Sheet is also described. ESA

N76-19708 Wisconsin Univ., Madison. Center for Climatic Research.
VARIANCE SPECTRUM OF HOLOCENE CLIMATIC FLUCTUATIONS IN THE NORTH ATLANTIC SECTOR
J. E. Kutzbach and R. A. Bryson *In* WMO Long-term Climatic Fluctuations 1975 p 97-104 refs (For availability see N76-19697 10-47)
(Grant NSF GA-10651X)
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An initial attempt to identify the general character of the variance spectrum of climate fluctuations over time scales of order 10,000 years to one year, based largely upon records from central England is described. It is noted that all spectra are red with the degree of redness (hence variance) increasing towards lower frequencies. ESA

N76-19709 Hohenheim Univ., Stuttgart (West Germany).
THE DISTRIBUTION PATTERN OF HOLOCENE CLIMATIC CHANGE IN THE NORTHERN HEMISPHERE
Burkhard Frenzel *In* WMO Long-term Climatic Fluctuations 1975 p 105-118 refs (For availability see N76-19697 10-47)
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The factors to be taken into consideration before evaluating past changes of climate are briefly considered, followed by a discussion of the difficulties in finding out these times when climate changed definitely. Using ecological data an attempt made to discard these times is described. ESA

N76-19710 Brown Univ., Providence, R.I.
THE LAST MILLENIUM OF CLIMATE: FORAMINIFERAL RECORDS FROM COASTAL BASIN SEDIMENTS c48
N. G. Kipp and D. P. Towner *In* WMO Long-term Climatic Fluctuations 1975 p 119-126 refs (For availability see N76-19697 10-47)
(Grant NSF GX-28672)
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Changes in foraminiferal assemblages in high deposition rate cores from coastal basins off Venezuela and California are described. The assemblages are correlated with terrestrial records for the last 1,000 years. ESA

N76-19711 Wisconsin Univ., Madison. Dept. of Meteorology.
LARGE-SCALE CIRCULATION AND WEATHER ANOMALIES IN THE CARIBBEAN AND CENTRAL AMERICA
Stefan Hastenrath *In* WMO Long-term Climatic Fluctuations 1975 p 127-133 refs (For availability see N76-19697 10-47)
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A project is described which attempts to establish the large-scale circulation characteristics associated with unusual weather conditions in the Caribbean and Central America on the basis of actual maps of meteorological parameters over the tropical oceans using an unprecedented mesh width. ESA

N76-19712 Wisconsin Univ., Madison. Dept. of Meteorology.
GLACIER RECESSION IN EAST AFRICA c43
Stefan Hastenrath *In* WMO Long-term Climatic Fluctuations 1975 p 135-142 refs (For availability see N76-19697 10-47)
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The present ice extent on three glacierated high mountain regions of East Africa is discussed followed by a description of a field program of the Lewis Glacier in an effort to obtain a better understanding of the long-term recession of East African glaciers in terms of mass and heat budget. ESA

N76-19713 Goteborg Univ. (Sweden). Lab. of Marine Geology.
SOME ASPECTS OF THE USE OF THE ANNUAL RINGS OF TREES IN CLIMATIC AND CHRONOLOGICAL STUDY
Bjoern Svenonius and Eric Olausson *In* WMO Long-term Climatic Fluctuations 1975 p 143-146 refs (For availability see N76-19697 10-47)
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Methods and techniques of measuring tree ring widths, ring radii and ring indices are described followed by a discussion of the relation between ring widths and meteorological conditions. The use of tree rings for studying variations in climate is also considered. ESA

N76-19714 Scripps Institution of Oceanography, La Jolla, Calif.
HISTORICAL FLUCTUATIONS OF CLIMATIC AND BIOCLIMATIC FACTORS AS RECORDED IN A VARVED SEDIMENT DEPOSIT IN A COASTAL SEA c48
Andrew Soutar *In* WMO Long-term Climatic Fluctuations 1975 p 147-158 refs Sponsored by NSF (For availability see N76-19697 10-47)
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A partial description of work within the Marine Life Sciences Research Group at the Scripps Institution of Oceanography directed towards the deciphering of ecologic and chronologic information contained in undisturbed anaerobic sediment records in the Santa Barbara Basin, California, is described. The oceanographic context of the Santa Barbara Basin is noted and the relationship between the sediment record of the basin and rainfall, temperature and productivity is discussed. ESA

N76-19715 State Oceanographic Inst., Moscow (USSR).
VARIATIONS IN THE ATMOSPHERIC CIRCULATION REGIME OVER THE OCEANS IN THE NORTHERN HEMISPHERE DURING RECENT DECADES

A. I. Sorkina *In* WMO Long-term Climatic Fluctuations 1975 p 159-164 refs (For availability see N76-19697 10-47)
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Investigations into the character of the atmospheric circulation over the oceans of the Northern Hemisphere made using annual synoptic material are discussed. In the case of the North Atlantic synoptic analyses are made over 60 years and for the Pacific Ocean over 47 years. The analyses obtained showed that during the last half-century considerable variations in the character of the atmospheric circulation have occurred. ESA

N76-19716 Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
EMPIRICAL ORTHOGONAL ANALYSIS OF PACIFIC SEA SURFACE TEMPERATURES c48
Bryan C. Weare, Alfredo R. Navato, and Reginald E. Newell *In* WMO Long-term Climatic Fluctuations 1975 p 167-174 refs Sponsored by NSF (For availability see N76-19697 10-47)
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The technique of empirical orthogonal function analysis is briefly explained and variables, employing the method, which adequately describe the spatial and temporal variability of sea surface temperatures for a large part of the Pacific Ocean are defined. ESA

N76-19717 Universidad Nacional Agraria, La Molina (Peru).
CLIMATE OF THE AMERICAN TROPICS AND SUBTROPICS IN THE 1960S AND POSSIBLE COMPARISON WITH CLIMATIC VARIATIONS OF THE LAST MILLENNIUM
W. A. Sanchez *In* WMO Long-term Climatic Fluctuations 1975 p 175-182 refs (For availability see N76-19697 10-47)
(Grant NSF GA-10651X)
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The climate of the American tropics and subtropics in the 1960s is discussed. It is suggested that there was a southward displacement of climatic patterns over southern North America, Central America and northern South America that paralleled similar displacements in Africa and Asia. Evidence is cited which supports the hypothesis that these changes resulted in a pattern of climate similar to that of the Little Ice Age. ESA

N76-19718 Lancaster Univ. (England).
FLUCTUATIONS OF SNOWFALL AND PERSISTENCE OF SNOW COVER IN MARGINAL-OCEANIC CLIMATES
Gordon Manley *In* WMO Long-term Climatic Fluctuations 1975 p 183-188 refs (For availability see N76-19697 10-47)
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The occurrence and persistence of snow cover in marginal oceanic climates is discussed. The rate of change in three dimensions of the observed annual duration of snow cover in Britain is described and it is noted that the rate of increase and height becomes more rapid in the cold unsettled season. The mechanism of climatic fluctuation is considered and it is demonstrated that a very small lowering of temperature would suffice to initiate glaciation in Scotland if it were maintained over a period of some 40 years. ESA

N76-19719 Meteorological Office (Gt. Brit.).
NORTH ATLANTIC CIRCULATION AND ASSOCIATED TEMPERATURE GRADIENTS
M. K. Miles *In* WMO Long-term Climatic Fluctuations 1975 p 189-196 refs (For availability see N76-19697 10-47)
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The relation of the surface westerlies over the Atlantic to the meridional air temperature gradients over the adjacent American continent and the Atlantic itself is examined. Mean values for the three winter months - December, January and February - have been used because the secular changes of interest over the last 80-90 years have been most pronounced in this season. ESA

N76-19720 Ocean-Atmosphere Research Inst., Cambridge, Mass.
ON THE QUESTION OF SYNCHRONISM OF CLIMATIC CHANGES IN THE NORTH ATLANTIC-ARCTIC AND NORTH PACIFIC-ARCTIC
I. I. Schell and E. N. Sabbagh *In* WMO Long-term Climatic Fluctuations 1975 p 197-205 refs (For availability see N76-19697 10-47)
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A study made of the pressures and air temperatures during 1921-1970, with the object of learning whether changes in the North Atlantic and North Pacific Lows are relatively synchronous with each other, is described. It is concluded that a moderate degree of synchronism in the circulation between the North Atlantic-Arctic and North Pacific-Arctic is shown by the southwestward retreat and filling-in of the Aleutian Low in the 1951-60 decade as compared with the 1921-50 period preceding it. ESA

N76-19721 Brown Univ., Providence, R.I.
BIOLOGICAL TRANSFER FUNCTIONS: A STRATEGY FOR THEIR DESIGN AND APPLICATION
J. Imbrie and T. Webb *In* WMO Long-term Climatic Fluctuations 1975 p 211-213 refs (For availability see N76-19697 10-47)
Copyright.

The use of biological transfer functions in achieving an effective interplay between climatic theory and paleoclimatic data is briefly reviewed. Problem areas are outlined and methods of writing the functions described. ESA

N76-19722 Massachusetts Univ., Amherst. Dept. of Geology and Geography.
SECULAR FLUCTUATIONS OF PRECIPITATION IN THE ROCKY MOUNTAIN REGION
Raymond S. Bradley and Roger G. Barry (Colorado Univ., Boulder) *In* WMO Long-term Climatic Fluctuations 1975 p 215-222 refs (For availability see N76-19697 10-47)
(Contract DI-14-06-D-70521; Grants NSF GA-40256; NSF GA-33177)
Copyright.

Instrumentally recorded precipitation data collected over the past 100-200 years for the Rocky Mountain region was examined for secular variations because of its significance to potential cloud seeding operations and its importance to tree growth in the area. It is concluded that seasonal precipitation totals have undergone very significant changes over the last 120 years. ESA

N76-19723 Yamagata Univ. (Japan).
A REVIEW OF CLIMATIC CHANGE IN JAPAN (WITH SOME CONTRIBUTIONS TO THE EVIDENCE OF SUNSPOT-CLIMATE RELATIONS)
T. Yamamoto *In* WMO Long-term Climatic Fluctuations 1975 p 223-232 refs (For availability see N76-19697 10-47)
Copyright.

The influece of Far East monsoons and prevailing westerlies on the climate of Japan is discussed. When the prevailing westerlies over the Asian continent are weak, the stational trough of the planetary wave changes its mean position towards the west resulting in a strong monsoon type climate. On the contrary, strong prevailing westerlies result in weak monsoons. The sunspot cycle is also studied in relation to climate. It is concluded that the various climatic factors in Japan have been changing in the past 80 years with a common rhythm which reflects the attenuation of the monsoon strength through winter and summer. ESA

N76-19724 Japan Meteorological Agency, Tokyo.
WORLD-WIDE UNUSUAL WEATHER WATCH IN JAPAN AND STUDY ON CLIMATIC CHANGE IN THE NORTHERN HEMISPHERE
E. Uchida and T. Asakura *In* WMO Long-term Climatic Fluctuation 1975 p 233-242 refs (For availability see N76-19697 10-47)
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The efforts of the Japan Meteorological Agency in understanding the actual trend of climatic variability and thereby establishing the long-term prospects is discussed. Climatic information is analyzed so as to detect any systematic deviation in monthly values of climatic parameters from normal values over the past 30 year period. Recent climatic changes - cooling, heat transfer and atmospheric energy trends - in the Northern Hemisphere are described. ESA

N76-19725 New Zealand Meteorological Service, Wellington.
FLUCTUATIONS AND TRENDS IN INDICES OF THE SOUTHERN HEMISPHERIC CIRCULATION
K. E. Trenberth *In* WMO Long-term Climatic Fluctuations 1975

p 243-253 refs (For availability see N76-19697 10-47)
Copyright.

An earlier study by the author of departures from normal of monthly mean sea level pressures found two modes (P1 and P2) to be of particular interest. The role they have played in the past in different circulation regimes is studied here by obtaining approximations to the P1 and P2 indices from a consideration of relatively few station pressure values. Investigation of the resulting time series shows the importance of P1 and P2 prior to 1959, the presence of secular trends and the relationship between these indices and mean conventional circulation indices of the zonal and meridional flow. ESA

N76-19726 Washington Univ., Seattle.
SOME CHANGES IN TROPICAL RAINFALL REGIMES, AUSTRALIA
John Stewart *In* WMO Long-term Climatic Fluctuations 1975 p 255-264 refs (For availability see N76-19697 10-47)
Copyright.

The annual and seasonal registrations of rainfall at a large sample of stations in tropical Australia are examined for trend within the period of record up to 1970. The effects of changes in mean anticyclonic location and intensity on the incidence of rainfall, having regard to the nuances of response induced by relief and station exposure are discussed. ESA

N76-19727 Main Geophysical Observatory, Leningrad (USSR).
ENERGETICS ESTIMATION OF CLIMATIC TRENDS IN THE PRESENT CENTURY
E. P. Borisenkov *In* WMO Long-term Climatic Fluctuations 1975 p 269-278 refs (For availability see N76-19697 10-47)
Copyright.

The energetics principle of estimation and interpretation as a method of analyzing the climatic trends of the past century are discussed. The role of different factors of natural and anthropogenic origin which could influence the climate is described and procedures for calculating useful potential energy are outlined. Annual mean anomalies of surface temperature and the time variation of annual mean potential energy are given and three theories based on the data are discussed. ESA

N76-19728* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF VOLCANIC ACTIVITY ON CLIMATE
James B. Pollack, Owen B. Toon (Cornell Univ., Ithaca, N. Y.), and Carl Sagan (Cornell Univ., Ithaca, N. Y.) *In* WMO Long-term Climatic Fluctuations 1975 p 279-285 refs (For availability see N76-19697 10-47)
Copyright.

Radiative transfer calculations of the global energy balance were performed to estimate the change in mean surface temperature that results from the addition of volcanic aerosols to the stratosphere. Results of the calculations are consistent with stratospheric warming observed in the last few months following the eruption of Mt. Agung and the average surface temperature decrease found for the two year period following major volcanic explosions. ESA

N76-19729 Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
EFFECT OF INSOLATION CHANGES ON LATE SUMMER SNOW COVER IN NORTHERN CANADA
L. D. Williams *In* WMO Long-term Climatic Fluctuations 1975 p 287-292 refs (For availability see N76-19697 10-47)
(Grant NSF GA-40248)
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The extent of snow cover which might have existed in the Canadian arctic at 116,000 BP, when Milankovich variations gave a summer radiation minimum at these latitudes, and just preceding the apparent large increase in snowfall and glacial maximum there, is estimated. The concepts and methods employed are outlined and the simulation results discussed. ESA

N76-19730 Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
DIAGNOSTIC STUDIES OF THE PAST ICE AGE
Reginald E. Newell and Gerald F. Herman *In* WMO Long-term Climatic Fluctuations 1975 p 293-300 refs Sponsored in part by U.S. Energy Res. and Develop. Admin. and NSF (For availability see N76-19697 10-47)
Copyright.

The use of paleoclimatic reconstructions as a major component of diagnostic studies is discussed by considering how the momentum and energy budgets of the atmosphere-ocean system during the past Ice Age differed from those of today. Reasons for the differences are outlined: for example change in solar output and the Ice Age as a natural consequence of imbalances in the ocean-atmosphere energy budget. ESA

N76-19731 Washington Univ., Seattle.
THE AGEING AND CIRCULATION OF WEST ATLANTIC DEEP WATER **c48**
Minze Stuiver and Wallace S. Broecker (Lamont-Doherty Geol. Obs.) *In* WMO Long-term Climatic Fluctuations 1975 p 301-310 refs Sponsored by NSF (For availability see N76-19697 10-47)
Copyright.

The procedures used for carbon 14 studies of Atlantic Ocean samples are outlined. The general circulation patterns in the Atlantic are described and carbon 14 age determination results are discussed. ESA

N76-19732 Norwegian Meteorological Inst., Blindern.
VARIATIONS IN THE SOLAR INTENSITY DEMONSTRATED BY MEANS OF HELIOGRAPH RECORDINGS
Knud Frydendahl *In* WMO Long-term Climatic Fluctuations 1975 p 311-318 (For availability see N76-19697 10-47)
Copyright.

An analysis of solar records in various countries was made in an attempt to gain historical knowledge of variations in solar intensity, by making use of the fact that a certain threshold value must be exceeded before heliographic registration takes place. Solar variations in Denmark from 1894 to 1940 are compared with solar variations in other countries and their similarity is discussed. A worldwide simultaneous increase in recorded sunshine during the terminal hours of daylight occurred in 1916 and is characteristic of an increase in solar intensity. Changes in the solar intensity around 1916 at an altitude of 100 km and changes in the solar constant around 1916 are also noted. ESA

N76-19733 California Univ., Los Angeles.
VOLCANISM AND RADIOCARBON DATES AND CLIMATE
L. M. Libby and W. F. Libby *In* WMO Long-term Climatic Fluctuations 1975 p 319-321 refs (For availability see N76-19697 10-47)
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The hypothesis that the emission of carbon dioxide by volcanoes reduces the concentration of radiocarbon in atmospheric carbon dioxide and thus produces errors in the radiocarbon dates for the past millenia is reported by studies which conclude that volcanism has been too inactive to have caused a noticeable correction in radiocarbon dates and that volcanoes appear to be evolving one percent or less of the carbon dioxide being evolved by fossil fuels. ESA

N76-19734 National Center for Atmospheric Research, Boulder, Colo.
EFFECT OF ANTHROPOGENIC AEROSOLS ON THE GLOBAL CLIMATE
William W. Kellogg, James A. Coakley, Jr., and Gerald W. Grams *In* WMO Long-term Climatic Fluctuations 1975 p 323-330 refs (For availability see N76-19697 10-47)
Copyright.

The large-scale climatic effects of manmade aerosols are considered. Observed changes in aerosol content are discussed and a theoretical estimate of global patterns of aerosol pollution is made. The effects of tropospheric aerosols on radiation balance are noted and inferences for climatic impact are made. ESA

N76-19735 Scripps Institution of Oceanography, La Jolla, Calif.
THE SEA AS A PRIMARY GENERATOR OF SHORT-TERM CLIMATIC ANOMALIES **c48**
J. Namias *In* WMO Long-term Climatic Fluctuations 1975 p 331-340 refs (For availability see N76-19697 10-47)
Copyright.

Recent results of empirical studies of sea surface temperature variations which lead to a numerical statistical model useful for identifying physical factors entering into coupled air-sea interactions on time scales of months and years are presented. A derived system which has been helpful in the preparation of seasonal predictions is also described. ESRO

N76-19736 RAND Corp., Santa Monica, Calif.
NUMERICAL MODELLING OF CLIMATE CHANGE: A REVIEW OF PROBLEMS AND PROSPECTS
W. L. Gates *In* WMO Long-term Climatic Fluctuations 1975 p 343-354 refs (For availability see N76-19697 10-47)
Copyright.

The nature of climate modeling is discussed and the present status and outstanding problems of modeling efforts such as parameterization, resolution, ocean coupling, are reviewed. Comments are made upon future requirements and the prospects for the modeling of climatic change. ESA

N76-19737 Meteorological Office (Gt. Brit.).
THERMAL AND OROGRAPHIC FORCING OF THE NORTHERN HEMISPHERE WINTER CIRCULATION IN A NUMERICAL MODEL
P. R. Rowntree *In* WMO Long-term Climatic Fluctuations 1975 p 355-364 refs (For availability see N76-19697 10-47)
Copyright.

The results of a series of general circulation experiments to isolate the forcing effects on the Northern Hemisphere winter atmosphere of (a) tropical oceans and tropical continents, (b) extratropical thermal contrasts between warm oceans and cold continents, and (c) orographic forcing, are presented. A brief review of relevant literature is also included. ESA

N76-19738 National Center for Atmospheric Research, Boulder, Colo.
VOLCANIC DUST, SUNSPOTS AND LONG-TERM CLIMATE TRENDS: THEORIES IN SEARCH OF VERIFICATION
Stephen H. Schneider and Clifford Mass (Wash. Univ.) *In* WMO Long-term Climatic Fluctuations 1975 p 365-372 refs (For availability see N76-19697 10-47)
Copyright.

Volcanic dust and solar constant variations owing to variable sunspot activity are examined quantitatively to see whether they might account for the general patterns of surface temperature variation that have occurred since the year 1600 AD. The results are presented and discussed together with tables. ESA

N76-19739 National Center for Atmospheric Research, Boulder, Colo.
SIMULATION OF THE ATMOSPHERIC CIRCULATION WITH BOUNDARY CONDITIONS REPRESENTING THOSE OF PERIODS IN THE PAST: EXPERIMENTS WITH THE NCAR GLOBAL CIRCULATION MODEL
J. Williams *In* WMO Long-term Climatic Fluctuations 1975 p 373-380 refs (For availability see N76-19697 10-47)
Copyright.

The global circulation model used to examine the influence of glacial boundary conditions and extensive snowcover in the simulated atmospheric circulation is described. Glacial period simulations are discussed together with five experiments with varying boundary conditions. The significance of differences between experiments is compared and the results discussed. ESA

N76-19740* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SEASONAL CHANGES IN THE ATMOSPHERIC HEAT BALANCE SIMULATED BY THE GISS GENERAL CIRCULATION MODEL
P. H. Stone, S. Chow, H. M. Helfand, W. J. Quirk, and R. C. J. Somerville *In* WMO Long-term Climatic Fluctuations 1975 p 383-389 refs (For availability see N76-19697 10-47)
Copyright.

Tests of the ability of numerical general circulation models to simulate the atmosphere have focussed so far on simulations of the January climatology. These models generally present boundary conditions such as sea surface temperature, but this does not prevent testing their ability to simulate seasonal changes in atmospheric processes that accompany presented seasonal changes in boundary conditions. Experiments to simulate changes in the zonally averaged heat balance are discussed since many simplified models of climatic processes are based solely on this balance. ESA

N76-19741 National Center for Atmospheric Research, Boulder, Colo.
CLIMATE EXPERIMENTS WITH GENERAL CIRCULATION MODELS: STATISTICAL SIGNIFICANCE BARRIERS
Robert M. Chervin and Stephen H. Schneider *In* WMO Long-term Climatic Fluctuations 1975 p 391-397 refs (For availability see N76-19697 10-47)
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In climate studies where it is the time average of the solutions and not their detailed behavior that is of interest, the unpredictability of circulation models is manifest as a noise level superimposed on any finite climatological time average. The inherent noise climatology of general circulation models is determined in order to be able to distinguish between signal and noise in climate experiments and thereby determine the statistical significance of particular cases. The time averaged response of the NCAR general circulation model to random perturbations in the initial conditions, while leaving all boundary conditions fixed is also examined. ESA

N76-19742 Scripps Institution of Oceanography, La Jolla, Calif.
MID-LATITUDE SEA SURFACE TEMPERATURE ANOMALY EXPERIMENTS WITH NCAR GENERAL CIRCULATION MODEL
Joseph C. K. Huang *In* WMO Long-term Climatic Fluctuations 1975 p 399-406 refs (For availability see N76-19697 10-47)
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The NCAR's six layer general circulation model was used to investigate mid-latitude atmospheric responses to the North Pacific oceanic forcing. The model is described together with experiments. The results indicate that the cyclonic activity was increased above the warm sea surface temperature anomalies and depressed above the cold. ESA

N76-19743 Princeton Univ., N.J.
THE EFFECT OF SEASONALLY VARYING INSOLATION ON A SIMPLE ALBEDO-FEEDBACK MODEL
M. J. Suarez and I. M. Held *In* WMO Long-term Climatic Fluctuations 1975 p 407-413 refs (For availability see N76-19697 10-47)
(Grants NOAA-04-3-022-33; NSF GA-40341)
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A highly parameterized climate model is described which predicts zonally the averaged tropospheric lapse rates or static stability as well as zonally averaged mean atmosphere and surface temperature. Experiments were performed with annual mean solar insolation as well as with seasonally varying insolation. Results are discussed, one of the most interesting being the sensitivity of permanent snow cover to variations in the solar constant. ESA

N76-19744 California Univ., Livermore. Lawrence Livermore Lab. Lawrence Livermore Lab.
COMPARATIVE CLIMATIC IMPACT OF INCREASED STRATOSPHERIC AEROSOL LOADING AND DECREASED SOLAR CONSTANT IN A ZONAL CLIMATE MODEL
Michael C. MacCracken and Gerald L. Potter *In* WMO Long-term Climatic Eluctuations 1975 p 415-420 refs Sponsored by Dept. of Transportation (For availability see N76-19697 10-47)
Copyright.

The numerical experiments described seek to investigate the sensitivity of a particular climate model (ZAM2) to two factors suggested as influential in climatic change, namely changes in stratospheric aerosol loading and changes in the input of solar radiation to the earth/atmosphere system. Equilibrium modeling results using ZAM2 with annual average solar radiation for larger perturbations of the two factors indicate that the simulated climate changes are similar for reduced solar constant and increased stratospheric aerosol. ESA

N76-19745 Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. of Theoretical Meteorology.

RESPONSE OF THE ZONALLY-AVERAGED STEADY STATE OF THE GENERAL CIRCULATION TO VARIATIONS OF EXTERNAL CONDITIONS AND TO FORCED STANDING WAVES

J. Egger *In* WMO Long-term Climatic Fluctuations 1975 p 421-424 refs (For availability see N76-19697 10-47)

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A three-dimensional model of the steady state of the general circulation is described. The model consists of two parts: a nonlinear Statistical-Dynamic (SD) model of the zonally averaged steady state and a linear model of the zonal perturbations of this state which are caused by zonally varying forcing functions. Solutions from the SD model are fed into the linear model. The response of the annual mean circulation to orographically induced standing waves was examined in this manner and the results are discussed. ESA

N76-19746 Academy of Sciences (USSR), Moscow. P. O. Shirschov Inst. of Oceanology.

ROLE OF THE OCEANS IN CLIMATIC MODELS c48

A. S. Monin *In* WMO Long-term Climatic Fluctuations 1975 p 427-428 (For availability see N76-19697 10-47)

Copyright.

The characteristics of the ocean as climatic elements are considered and small and large scale air sea interactions are reviewed. The modeling problems of oceanic processes, ASI and climate are also briefly noted. ESA

N76-19747 Ocean-Atmosphere Research Inst., Cambridge, Mass.

SPACE-TIME COHERENCE ANALYSIS FOR A PARTIAL SOLUTION OF THE LONG-RANGE WEATHER PREDICTION (FORESHADOWING) PROBLEM

I. I. Schell *In* WMO Long-term Climatic Fluctuations 1975 p 429-437 refs (For availability see N76-19697 10-47)

(Grant NSF GA-17804)

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The widespread phenomenon of inertia in the atmosphere and the oceans that gives rise to temporal coherence in the circulation in certain regions and seasons allows weather prediction from the preceding season's circulation anomalies. Space-time coherence relationships are discussed together with Southwest North Pacific pressure and Hawaii rainfall. Evidence is presented for a partial solution of the problem of predicting Hawaii's winter rainfall from an analysis of the autumn to winter temporal coherence in the circulation in the Southwest North Pacific and south of Hawaii. ESA

N76-19748 Scripps Institution of Oceanography, La Jolla, Calif.

EIGENVECTOR ANALYSIS AND PREDICTION OF SEA SURFACE TEMPERATURE FLUCTUATIONS IN THE NORTHERN PACIFIC OCEAN

T. P. Barnett and R. E. Davis *In* WMO Long-term Climatic Fluctuations 1975 p 439-450 refs (For availability see N76-19697 10-47)

(Contract N00014-75-A-0200-6043)

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The major features and scales of the sea surface temperature field in the North Pacific Ocean are summarized. An analysis of the data reveals that a major portion of SST variability is located in the geographic region where the Kuroshio and Oyashio currents collide. Attempts at statistically predicting the SST field are described. ESA

N76-19749 Meteorological Office (Gt. Brit.).

SOME QUASI-PERIODIC CHANGES IN RAINFALL IN AFRICA AND EUROPE

A. F. Jenkinson *In* WMO Long-term Climatic Fluctuations 1975 p 453-460 refs (For availability see N76-19697 10-47)

Copyright.

Rainfall and pressure statistics are presented and discussed for West Africa, the Nile, Lake Victoria and the United Kingdom. The quasi-periodic variations in amount are linked to the sunspot cycle. ESA

N76-19750 Main Geophysical Observatory, Leningrad (USSR).

MAN'S IMPACT ON THE GLOBAL CLIMATE

M. I. Budyka and I. L. Karol *In* WMO Long-term Climatic Fluctuations 1975 p 465-471 refs (For availability see N76-19697 10-47)

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The significance of human activities on the global climate is considered. Available data showing that at the present time a rise in the carbon dioxide concentration in the atmosphere and an increase in the mass of aerosols in the atmosphere due to fossil fuel combustion are important in climatic changes, is discussed. The international aspects of any action taken with the object of influencing climate are reviewed and the use of climatic models is noted. ESA

N76-19751 East Anglia Univ., Norwich (England). Climatic Research Unit.

REMARKS ON THE CURRENT CLIMATIC TREND AND ITS PERSPECTIVE

H. H. Lamb *In* WMO Long-term Climatic Fluctuations 1975 p 473-477 refs (For availability see N76-19697 10-47)

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General factors influencing changes in climate are discussed. Among the aspects considered are the changes of radiation receipt or of the general temperature level at the earth's surface, sea surface temperature, atmospheric pressure and circulation and oceanic circulation patterns. ESA

N76-19752 Department of Environment, Ottawa (Ontario).

THE IMPACT OF REGIONAL CLIMATIC FLUCTUATIONS ON MAN: SOME GLOBAL IMPLICATIONS

Derek Winstanley *In* WMO Long-term Climatic Fluctuations 1975 p 479-491 refs (For availability see N76-19697 10-47)

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Climatic variations as a driving force in biological evolution and a population controlling mechanism are discussed in general and then related to a more detailed regional case study, namely Africa. Fluctuations in African rainfall, hydrology, fisheries, ornithology and livestock are reviewed and their impact on food production described. ESA

N76-19753* Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.

CLIMATIC CHANGE ON MARS AND EARTH

Owen B. Toon (Cornell Univ.), Carl Sagan (Cornell Univ.), Peter J. Gierasch (Cornell Univ.), and James B. Pollack *In* WMO Long-term Climatic Fluctuations 1975 p 495-503 refs (For availability see N76-19697 10-47)

(Grant NGR-33-010-220)

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Work on climatic changes of Mars is reviewed and related to terrestrial problems. In particular the dust storms of Mars are discussed since these represent the only global climatic change which has been scientifically observed. The channels of Mars have provoked studies of climatic change and these are summarized together with polar laminae as a climatic change indicator. ESA

N76-19754# Royal Netherlands Meteorological Inst., De Bilt.

THE INTERPOLATION OF PRECIPITATION DEPTH [OVER HET INTERPOLEREN VAN DE NEERSLAGHOOGTE]

H. A. R. DeBruin 1975 49 p refs In DUTCH; ENGLISH summary

(KNMI-WR-75-2) Avail: NTIS HC $4.00

The method of interpolation developed by Eliassen, Drozdov, and Sepelevskij is described and applied to the precipitation data of 35 rain-gage stations to provide input data for a mathematical hydrological model for grid points without a rain gage. These data were processed for the period June 1966 to March 1972. The error of interpolation was related to the distances between the rain-gages, to the coordinates of the point of interpolation, and to the error of observation (which seems to be 10 to 20 %). The more general problem of the optimum density of a rain-gage network was also taken into consideration. One of the conclusions is that for ten-day periods the error of interpolation is about 20 to 25 %. It appears that the relatively poor quality of the data does not make possible a good understanding of the statistical structure of precipitation.

Author (ESA)

N76-19755# Royal Netherlands Meteorological Inst., De Bilt.

VARIATION OF THE WIND DIRECTION AFTER ONE OR

TWO HOURS [WINDRICHTINGSVARIATIE NA VERLOOP VAN EEN OF TWEE UUR]
P. J. Rijkoort 1975 60 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-8) Avail: NTIS HC $4.50

A statistical analysis of the changes of the average wind direction after one or two hours, using data from Schiphol airport weather station, was made in order to be able to predict the effect of suddenly liberated noxious gases. Values of wind direction differences after one or two hours (delta(1) resp. delta(2)) were determined. The frequency distribution of delta and the normal distribution of x = sin delta were established. The variances of x mean, of the standard deviation of x and of q, i.e. the number of wind direction changes greater than 90 deg, were calculated. Finally, the possibility of delta absolute being greater than or equal to the angle with which 80 % (resp. 90 %) certainty the wind direction will vary was determined. ESA

N76-19756# Royal Netherlands Meteorological Inst., De Bilt.
EXPERIMENTAL LONG RANGE WEATHER FORECASTING USING ADAM (ADAPTIVE ARITHMETICAL METHOD), PART 2 [EXPERIMENTELE WEERSVOORSPELLING OP LANGE TERMIJN MET DE ADAM (ADAPTIVE ARITHMETICAL MODEL), DEEL 2]
T. DeCrook 1975 14 p In DUTCH
(KNMI-V-265) Avail: NTIS HC $3.50

The Adaptive Arithmetical Method (ADAM) was used to predict the average daily temperature over a month. The following data were used: average daily temperature of the month to be predicted over the period 1881 to 1955; the large area weather conditions of each day preceding the month to be predicted in the period 1881 to 1955; the large area weather conditions each day in the period preceding the month to be predicted (for instance 1969). ADAM consists of three parts: preparation to the learning process, the unique learning phase, and the prediction. Various versions of ADAM were used, and it is concluded that one version produces some advantage in predicting the average daily temperature in a month. ESA

N76-19757# Royal Netherlands Meteorological Inst., De Bilt.
WIND MEASUREMENTS IN THE DELTA REGION [WINDMETINGEN IN HET DELTAGEBIED]
P. C. T. VanDerHoeven 1975 131 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-5) Avail: NTIS HC $6.00

Wind measurements were carried out over the period 1965 to 1967 in order to establish the influence of the Delta works, the Netherlands, on the climate in the Delta region. The measurement method is detailed and the choice of a suitable reference weather station is discussed. Monthly and annual variations of the wind velocity, in comparison with the wind velocity measured on board the weathership Goeree, were determined and the diurnal wind variations were established. The correlation of simultaneous wind parameters was investigated, and the results of all measurements are summarized. ESA

N76-19758# Royal Netherlands Meteorological Inst., De Bilt.
EMPIRICAL ORTHOGONAL EIGENFIELDS OF THE 500 mbar LEVEL: PROPERTIES AND USEFULNESS [EMPIRISCHE ORTHOGONALE EIGENVELDEN VAN HET 500 mbar-VLAK. EEN ONDERZOEK NAAR EIGENSCHAPPEN EN BRUIKBAARHEID]
J. P. DeJongh and S. Kruizinga 1975 78 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-10) Avail: NTIS HC $5.00

The properties were studied of the empirical orthogonal functions (EOF) of the 500 mbar level in a region useful to meteorology in the Netherlands. The applicability of these EOF to short-term weather forecasting was investigated by performing two experiments. In the first, the maximum temperature of the next day was predicted; in the second, analogous stream patterns were selected using EOF as well as enlisting the aid of altitudes directly in several ways. ESA

N76-19759# National Weather Service, Salt Lake City, Utah. Western Region.
DIGITIZED EASTERN PACIFIC TROPICAL CYCLONE TRACTS
Robert A. Baum and Glenn E. Rasch Sep. 1975 198 p ref
(COM-75-11479/3; NOAA-TM-NWS-WR-101; NOAA-75100701) Avail: NTIS HC $7.50 CSCL 04B

The report presents a climatological display that indicates the probability of a tropical cyclone located in a given part of the Pacific Ocean eventually moving onto the Mexican Coast. The study encompasses all sections of the central and eastern North Pacific. A series of 184 charts is presented consisting of two maps showing the source and eventual disposition of tropical cyclones passing through 2-1/2 degree latitude-longitude boxes during 14-year period, 1961-1974, and a bargraph showing the daily distribution of the storms which passed through the boxes. Also included is the number of storms that passed through each box and, when the total was five or more, the mean vector direction and speed and the mean scalar speed of the cyclones as they passed through the box. The Poisson probability of at least one cyclone being in any 2-1/2 x 2-1/2 degree box in any season is shown. GRA

N76-19760# National Oceanic and Atmospheric Administration, Washington, D.C.
FEDERAL COMPUTER PLAN FOR OPERATIONAL FORECASTING AND ATMOSPHERIC MODELING RESEARCH
Aug. 1975 52 p
(PB-246407/1; FCM-75-4) Avail: NTIS HC $4.50 CSCL 04B

The programs and future plans of Federal agencies involved in atmospheric numerical prediction services and modeling research are reviewed. Revisions to the original computer plan are presented along with an updated and condensed version of the plan. GRA

N76-19761# East Anglia Univ., Norwich (England). Climate Research Unit.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON MAPPING THE ATMOSPHERIC AND OCEANIC CIRCULATIONS AND OTHER CLIMATIC PARAMETERS AT THE TIME OF THE LAST GLACIAL MAXIMUM ABOUT 17,000 YEARS AGO, AND COMPARSIONS WITH TODAY'S CONDITIONS AND THOSE OF THE SO-CALLED LITTLE ICE AGE IN RECENT CENTURIES, COLLECTED ABSTRACTS
H. H. Lamb 1974 136 p refs Conf. held at England, 22 May 1973
(PB-245573/1; UEA-CRU-RP-2) Avail: NTIS HC $6.00 CSCL 04B

This is a record of the proceedings of the international (CLIMAP) conference held at Norwich, England in May 1973. The book is divided into seven different sections and related reports are enclosed within. The seven sections deal with (1) techniques; (2) the ocean record in maps; (3) the land record; (4) the ocean record and comparisons with the land record and between the hemispheres; (5) the little ice age and present climate; (6) meteorological analysis and interpretation of the available data on past climate; and (7) other approaches to the mapping problem and the relevance of mapping past climatic regimes to the practical problems of the present day and the future. GRA

N76-19762# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Systems Concepts Office.
REGRESSION OF ATMOSPHERIC DUST DATA TO ANALYTIC DERMENDJIAN GAMMA DISTRIBUTION FUNCTIONS
B. W. Fowler 25 Aug. 1975 9 p ref
(AD-A017079; RF-76-2) Avail: NTIS CSCL 04/2

This report presents a discussion of the fitting schemes for the regression of dust data to Dermendjian-type Gamma functions. These fitting techniques are demonstrated with actual field data and their shortcomings are indicated. Author (GRA)

N76-19763# Weather Wing (2nd), APO 332, New York.
CLIMATOLOGICAL GUIDE FOR LOWER SAXONY (KASSEL-HANNOVER) Final Report
Willi Laun 1 Aug. 1975 52 p refs
(AD-A014827; Rept-2WWP-105-27) Avail: NTIS CSCL 04/2

This pamphlet provides both meteorologists and operations personnel a ready climatological and planning reference for the Lower Saxony area in the Federal Republic of Germany. The

charts show average frequencies and limits of weather phenomena computed from observations taken over a period of years. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-19764*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECTIVE APPLICATION OF CONTINUOUS MEASUREMENT TO OBJECTIVE ANALYSIS OF PHYSICAL FIELDS OF THE OCEAN
G. A. Moiseyev Washington NASA Mar. 1976 18 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Morskiye Gidrofiz. Issled. (USSR), no. 1, 1974 p 118-130
(Contract NASw-2790)
(NASA-TT-F-16917) Avail: NTIS HC $3.50 CSCL 08C

A spectral density approach with an optimum interpolation method is used to develop an algorithm, which permits the use of measurement of a random, homogeneous field along parallel profiles. Correlations are developed for obtaining the dependence of the field reconstruction error on the distances between the profiles. A comparison is made with methods previously used, and the proposed method generally makes it possible to solve problems of planning measurements of physical fields in the ocean more effectively. Author

N76-19765*# Virginia Inst. of Marine Science, Gloucester Point.
WATER COLOR AND CIRCULATION SOUTHERN CHESAPEAKE BAY, PART 1
M. M. Nichols and Hayden H. Gordon Oct. 1975 133 p refs
(Contract NAS6-2327)
(NASA-CR-141404) Avail: NTIS HC $6.00 CSCL 08J

Satellite imagery from two EREP passes over the Rappahannock Estuary of the Chesapeake region is analyzed to chart colored water types, to delineate color boundaries and define circulatory patterns. Surface observations from boats and helicopters concurrent with Skylab overpass define the distributions of suspended sediment, transparency, temperature, salinity, phytoplankton, color of suspended material and optical ratio. Important features recorded by the imagery are a large-scale turbidity maximum and massive red tide blooms. Water movement is revealed by small-scale mixing patterns and tidal plumes of apparent sediment-laden water. The color patterns broadly reflect the bottom topography and the seaward gradient of suspended material between the river and the bay. Analyses of red, green and natural color photos by microdensitometry demonstrate the utility of charting water color types of potential use for managing estuarine water quality. The Skylab imagery is superior to aerial photography and surface observations for charting water color. Author

N76-19766# Royal Netherlands Meteorological Inst., De Bilt.
INTERACTIONS OF SEA AND ATMOSPHERE
J. A. Businger 1975 41 p refs
(KNMI-WR-75-6) Avail: NTIS HC $4.00

A review is presented, based on literature, of the theories and experiments concerning the study of sea atmosphere interactions. The sea-air interfaces itself and the molecular layers adjacent to it are discussed. The scale of the interactions is then expanded to include the entire ocean-atmosphere system. ESA

N76-19767# American Inst. of Biological Sciences, Arlington, Va.
WORKSHOP ON PROBLEMS OF ASSESSING POPULATIONS OF NEKTON Final Report
W. G. Pearcy 1 Aug. 1975 36 p refs Workshop held at Santa Barbara, Calif., 25-27 Feb. 1975
(Contract N00014-70-A-0140-0003; NR Proj. 104-008)
(AD-A016245; ONR-ACR-211) Avail: NTIS CSCL 08/1

A workshop was held in Santa Barbara, California, to discuss problems associated with assessing the populations of nekton or strongly swimming animals such as squids, shrimps and fishes. Sessions were held to discuss four major methods of assessing nekton populations: (1) Net collections, (2) Acoustics, (3) Egg/larval surveys, (4) Visual methods, remote sensing and feeding habit studies. An attempt was made to review the state of the art for each method including advantages, disadvantages and an evaluation of the accuracy of assessment. In addition, an attempt was made to identify important scientific problems and to recommend areas for future research and development. GRA

N76-19768# Naval Research Lab., Washington, D.C.
FURTHER RESULTS ON NONLINEAR ENERGY TRANSFER IN GRAVITY-CAPILLARY WAVE SPECTRA, WITH VISCOUS CONSIDERATIONS
Gaspar R. Valenzuela 17 Sep. 1975 22 p refs
(RR1310341)
(AD-A015620; NRL-7913) Avail: NTIS CSCL 08/3

Further studies have been made on the effect of viscosity and on the spectral-shape dependence on the energy flux of a gravity-capillary spectrum. Viscous effects have been included as a perturbation of the inviscid results and also in a more exact manner, producing an effective decoupling of gravity and capillary waves, suggesting that the growth of gravity-capillary waves in the front face of the spectrum must be mostly dependent on the energy flux from the wind. However, at an early stage of development, the nonlinear resonant interactions may still play a significant contribution to the growth of the gravity-capillary wave spectrum. The investigation is concluded with a brief description on the effect of nonlinear resonant interactions and surface tension to the second-order contributions to the doppler spectrum of radio waves backscattered from a water-wave system. GRA

N76-19769# Naval Undersea Center, San Diego, Calif.
ACOUSTIC AND RELATED PROPERTIES OF THE SEA FLOOR: DENSITY AND POROSITY PROFILES AND GRADIENTS Research and Development Report, Feb. 1974 - Jan. 1975
Edwin L. Hamilton Jul. 1975 50 p refs
(AD-A016243; NUC-TP-459) Avail: NTIS CSCL 08/10

The general objectives of this investigation were (1) to determine and study those characteristics of the sea floor that affect the propagation of sound and the prediction of sonar performance; (2) to support underwater acoustic experiments and theory by furnishing information on the mass physical properties of sediments and rocks in the form of geoacoustic models of the sea floor; and (3) to develop models of the sea floor which include gradients of sound velocity and attenuation, density, and elastic properties. The specific objectives of this particular report were to determine and predict density profiles and gradients in common sediment and rock layers of the sea floor. GRA

N76-19770# Woods Hole Oceanographic Institution, Mass.
VECTOR AVERAGING CURRENT METER SPEED CALIBRATION AND RECORDING TECHNIQUE
James R. McCullough Sep. 1975 54 p refs
(Contracts N00014-66-C-0241; N00014-74-C-0262; NR Proj. 083-004)
(AD-A016219; WHOI-75-44) Avail: NTIS CSCL 08/3

This report provides a discussion of the speed calibration equations used at the Woods Hole Oceanographic Institution (WHOI) for the WHOI-AMF vector averaging current meter (VACM) and the recording technique used in the instrument. GRA

N76-19771# Naval Undersea Center, San Diego, Calif.
ACOUSTIC AND RELATED PROPERTIES OF THE SEA FLOOR: SHEAR WAVE VELOCITY PROFILES AND GRADIENTS Research and Development Report, Jan. - Jun. 1975
Edwin L. Hamilton Jul. 1975 34 p refs
(AD-A016814; NUC-TP-472) Avail: NTIS CSCL 20/1

Measurements of the velocity of shear waves at various depths in common watersaturated sediments were collected from published studies. Because measurements in marine sediments are rare, most of this information came from land geology and geophysics. This report considered the two end-member sediment types: sand and silt-clays, including turbidites which are alternating layers of silt-clay with thinner layers of silt and sand. The shear velocity measurements in sands were 29 selected, in

situ values at depths to 12m. Data from laboratory and field studies indicate that shear wave velocity is proportional to the 1/3 to 1/6 power of pressure or depth in sands; that the 1/6 power is not reached until very high pressures are applied; and that for most sand bodies the exponent is between 3/10 and 1/4. Data from laboratory studies allow prediction of compressional wave (sound) as a function of depth in sands. The shear velocity measurements in silt-clays and turbidites used in this report include 47 measurements to depths of 650m. Three linear equations were used to characterize the data. The shear velocity gradient in the upper 40m(4.65/sec) is 4-5 times greater than is the compressional wave (sound) velocity gradient in comparable sediments. At deeper depths, shear velocity and compressional velocity gradients are comparable. This report concludes with methods for prediction of shear wave velocity profiles and gradients in sea-floor sediments. This result will be of immediate use in a sophisticated model that determines sound energy losses when an acoustic wave interacts with the sea floor. GRA

N76-19772# Washington Univ., Seattle. Dept. of Oceanography.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. AUGUR, A THREE-DIMENSIONAL SIMULATION PROGRAM FOR NON-LINEAR ANALYSIS OF AQUATIC ECOSYSTEMS
D. L. Morishima, P. B. Bass, and J. J. Walsh Nov. 1974 245 p ref Submitted for publication
(Grants NSF GB-18568; NSF GB-35880)
(PB-245566/5; TR-7; NSF/IDOE-75-51) Avail: NTIS HC $8.00 CSCL 09B

A description is given of the simulation package known as AUGUR. The AUGUR is a three-dimensional simulation package written in FORTRAN 4 and COMPASS and implemented on the CDC 6400 under the SCORE 3.4 operating system. Its main design is to handle general spatial bookkeeping problems and basic input-output of data thus leaving the main problem of modelling to the user. This general user simulation program was developed both to facilitate existing research and to provide a broad-based technique for analysis of the nonlinear biological (40 variables) and spatial (33,000 grid points) complexities of aquatic ecosystems. Documentation of this relatively complex program is provided for both the scientist and the programmer. GRA

N76-19773# National Ocean Survey, Rockville, Md.
AN AVERAGE, LONG-PERIOD, SEA-LEVEL SERIES FOR THE UNITED STATES
Steacy D. Hicks and James E. Crosby Sep. 1975 11 p refs
(COM-75-11463/7; NOAA-TM-NOS-15) Avail: NTIS HC $5.50 CSCL 08E

An average, long period, sea level series for the United States (except Alaska and Hawaii), from which a representative curve and a single-value rate were derived, is presented. The series was obtained by averaging commonlength, uninterrupted, sea level series obtained from tide gage measurements. The averaging was by coastal area. The curve, with amplitudes of its meteorological and oceanographic oscillations of periods less than 5 1/3 years attenuated more than 90%, shows the relative, apparent secular trend and its changes for the United States as a whole. During the 34 year period, 1940 through 1973, sea level rose along the coasts of the United States at the average rate of 1.5 mm (0.005 ft) per year. Author

N76-19774# Naval Postgraduate School, Monterey, Calif.
THE PREDICTION OF SEA-SURFACE TEMPERATURE ANOMALIES USING A 10-LEVEL PRIMITIVE EQUATION MODEL M.S. Thesis
Kenneth Howard Hunt Sep. 1975 85 p refs
(AD-A017534) Avail: NTIS CSCL 08/10

Preliminary experiments in the numerical prediction of large scale sea-surface temperature anomalies are made using a 10-level primitive equation model with 300-km horizontal resolution covering a rectangular basin in the North Pacific. The model is first integrated over an 11-year period to statistical equilibrium using time dependent wind and thermal forcing. The monthly normal climatology, generated by the model in this long term integration, is then used along with observed sea-surface temperature anomalies to define the initial state. The results show that inclusion of salinity in the model may produce more accurate predictions of high latitude cold anomalies. The most accurate of the predictions removed all of the anomalous diffusion terms in the governing equations. Data for the observed temperature anomalies were not available in depth, thus initialization of the anomalies below the surface was superficial. Consequently, the effects of vertical advection were not fully realized, indicating a need for future experimentation with a more accurately defined initial profile of the anomalies in the initial conditions. Author (GRA)

N76-19775# Naval Oceanographic Office, Washington, D.C.
INTERMEDIATE AND DEEP CURRENT MEASUREMENTS IN THE NORTHEAST PACIFIC OCEAN Final Technical Report
Marshall D. Earle Jul. 1975 36 p refs
(AD-A017236; NOO-TR-232) Avail: NTIS CSCL 08/3

Ocean currents were measured in the central northeast Pacific, from 30 degrees N to 40 degrees N and 140 degrees W to 150 degrees W, with nine arrays of moored current meters during autumn 1973. Current meter records at depths from 700 m to 5420 m were analyzed to determine the characteristics of intermediate and deep currents within the central northeast Pacific. The currents in this region have very low speeds which generally decrease with increasing depth. Contributions to the time-dependent currents are primarily from oscillatory motions at the local inertial frequencies and the semidiurnal tidal frequency. Spectral analysis indicates that tidal frequency motion is essentially due to baroclinic internal tides and not barotropic surface tides. GRA

N76-19776# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET MATERIAL ON INTERNAL WAVES, NUMBER 5, JUNE - OCTOBER 1975
Stuart G. Hibben, L. H. Boylan, and M. Ness 10 Nov. 1975 34 p
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A017553) Avail: NTIS CSCL 08/3

The report is the fifth bibliography of Soviet open-source publications relating to internal wave studies. It covers material received from June through October 1975. The main selection criteria are studies of small-scale variation in ocean parameters and of airborne techniques for deducing internal wave conditions. GRA

N76-19777# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EFFECT OF POROSITY ON THE HYDROSTATIC COMPRESSION OF ICE
Anthony J. Gow and William Sheehy Oct. 1975 15 p refs
(AD-A017302; CRREL-SR-234) Avail: NTIS CSCL 08/12

A cathetometer was used in conjunction with a window-equipped pressure chamber to measure linear deformation in porous polycrystalline ice samples compressed hydrostatically at pressures of up to 0.31 kb. Tests show that a porosity as little as 1% can increase the compressibility of ice four- or fivefold. However, the compression is of a substantially nonelastic nature, since very little recovery (expansion) occurs during and following pressure release. Pore closure, which is virtually complete at the higher pressures, can be attributed to a combination of plastic and cataclastic deformation of ice in the walls of the pores. GRA

N76-19705 Lamont-Doherty Geological Observatory, Palisades, N.Y.
THERMAL AND OCEANIC STRUCTURES OF THE ATLANTIC THROUGH A GLACIAL-INTERGLACIAL CYCLE
Andrew McIntyre, A. W. H. Be, James D. Hays, James V. Gardner, Jose A. Lozano, Barbara Molfino, Warren Prell, Hans R. Thierstein, Thomas Crowley (Brown Univ.), John Imbrie (Brown Univ.) et al *In* WMO Long-term Climatic Fluctuations 1975 p 75-80 refs (For availability see N76-19697 10-47)
(Grants NSF IDO-71-04204-A04E; NSF DES-73-00467-A01)
Copyright.

N76-19710 Brown Univ., Providence, R.I.
THE LAST MILLENIUM OF CLIMATE: FORAMINIFERAL RECORDS FROM COASTAL BASIN SEDIMENTS

N. G. Kipp and D. P. Towner *In* WMO Long-term Climatic Fluctuations 1975 p 119-126 refs (For availability see N76-19697 10-47)
(Grant NSF GX-28672)
Copyright.

N76-19714 Scripps Institution of Oceanography, La Jolla, Calif.
HISTORICAL FLUCTUATIONS OF CLIMATIC AND BIOCLIMATIC FACTORS AS RECORDED IN A VARVED SEDIMENT DEPOSIT IN A COASTAL SEA
Andrew Soutar *In* WMO Long-term Climatic Fluctuations 1975 p 147-158 refs Sponsored by NSF (For availability see N76-19697 10-47)
Copyright.

N76-19716 Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
EMPIRICAL ORTHOGONAL ANALYSIS OF PACIFIC SEA SURFACE TEMPERATURES
Bryan C. Weare, Alfredo R. Navato, and Reginald E. Newell *In* WMO Long-term Climatic Fluctuations 1975 p 167-174 refs Sponsored by NSF (For availability see N76-19697 10-47)
Copyright.

N76-19731 Washington Univ., Seattle.
THE AGEING AND CIRCULATION OF WEST ATLANTIC DEEP WATER
Minze Stuiver and Wallace S. Broecker (Lamont-Doherty Geol. Obs.) *In* WMO Long-term Climatic Fluctuations 1975 p 301-310 refs Sponsored by NSF (For availability see N76-19697 10-47)
Copyright.

N76-19735 Scripps Institution of Oceanography, La Jolla, Calif.
THE SEA AS A PRIMARY GENERATOR OF SHORT-TERM CLIMATIC ANOMALIES
J. Namias *In* WMO Long-term Climatic Fluctuations 1975 p 331-340 refs (For availability see N76-19697 10-47)
Copyright.

N76-19746 Academy of Sciences (USSR), Moscow. P. O. Shirschov Inst. of Oceanology.
ROLE OF THE OCEANS IN CLIMATIC MODELS
A. S. Monin *In* WMO Long-term Climatic Fluctuations 1975 p 427-428 (For availability see N76-19697 10-47)
Copyright.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-19778*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE GEOMETRY OF THE AVIAN WING (STUDIES ON THE BIOPHYSICS AND PHYSIOLOGY OF AVIAN FLIGHT 2)
Hans Oehme and U. Kitzler Washington NASA Feb. 1976 7 p refs Transl. into ENGLISH from Zool. Jahrb. Abt. Allgem. Zool. Physiol. Tiere (Jena), v. 79, no. 3, 1975 p 402-424
(Contract NASw-2790)
(NASA-TT-F-16901) Avail: NTIS HC $3.50 CSCL 06C

The variation in chord depth along a fully extended wing was studied in 14 bird species. A model of chord depth distribution was derived. The functional and aerodynamic aspects of pinion structure were discussed. Neither the aspect ratio of the wing nor the mode of flight of the bird was clearly related to the form of the chord depth distribution. Results show that separated primaries may improve the aerodynamic properties of the wing by reducing induced drag. This applies only to large birds however results also show that a slit wing aids in generating lift. Despite external similarities in feather position, the mechanism of superated primaries in special forms of powered flight, such as hovering, is quite different, because unsteady processes dominate flow around the wing. Diagrams of the various bird wing configurations are shown. Author

N76-19779*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIENCES WITH A NEW COLD STERILIZATION UNIT
W. Heiss and M. Schmidt-Mende Washington NASA Mar. 1976 11 p refs Transl. into ENGLISH from Muench. Med. Wochschr. (Munich), v. 104, no. 12, 23 Mar. 1961 p 560-562
(Contract NASw-2791)
(NASA-TT-F-16972) Avail: NTIS HC $3.50 CSCL 06B

The use of ethylene oxide for cold sterilization is discussed. The chemical and physical properties of this compound are first reviewed. Sterilization methods are then described along with applications of these methods to the sterilization of medical equipment. D.M.L.

N76-19780*# Scientific Translation Service, Santa Barbara, Calif.
A NEW COLD STERILIZATION UNIT
M. Schmidt-Mende and W. Heiss Washington NASA Mar. 1976 34 p refs Transl. into ENGLISH from Tech. Neuheiten (West Germany), v. 33, no. 1, Jan. 1962 p 40-41
(Contract NASw-2791)
(NASA-TT-F-16919) Avail: NTIS HC $4.00 CSCL 06B

The reasons for an absolutely reliable cold sterilization method are outlined. Experience with a new sterilization unit operating with ethylene oxide under tension, operating at 5.5 atmospheres and 55 C is discussed. The device can also be used for packaging infrequenly used operating room equipment in plastic bags.
Author

N76-19781*# Kanner (Leo) Associates, Redwood City, Calif.
LECTURES OF ANIMAL HEAT: ON THE EFFECTS OF HEAT AND ON FEVER
Claude Bernard Washington NASA Mar. 1976 33 p refs Transl. into ENGLISH from the book "Lecons sur la Fievre: Chaleur Febrile et Sources de la Chaleur Febrile" Paris, Bailliere, 1876 Chapters 20, 21, p 405-445
(Contract NASw-2790)
(NASA-TT-F-16925) Avail: NTIS HC $4.00 CSCL 06C

Excess heat is considered to be by far the most important sympton in fever. Not only is heat distribution altered, as has been believed in the past, but also, heat production is increased. This assumption is supported by experiments on measurement of the heat radiated by the human body during fever, plus comparative studies of CO2 exhalation, urea excretion, and weight loss between normal and febrile subjects. This excess heat may cause the death of the patient; if prolonged, it will always cause tissue degeneration. The temperature of the body is regulated by specific heat-producing and cold-producing nerves in the autonomic nervous system. The location of these nerves is studied with reference to experiments on the effects on body temperature of severance of the spinal cord at various levels. Author

N76-19782*# Organon Diagnostics, El Monte, Calif.
WATER SYSTEM VIRUS DETECTION Final Report, Jul. 1974 - Sep. 1975
A. S. Fraser, A. F. Wells, and H. J. Tenoso Nov. 1975 168 p refs
(Contract NAS9-14102)
(NASA-CR-147491; Rept-124-F) Avail: NTIS HC $6.75 CSCL 06I

A monitoring system developed to test the capability of a water recovery system to reject the passage of viruses into the recovered water is described. A nonpathogenic marker virus, bacteriophage F2, is fed into the process stream before the recovery unit and the reclaimed water is assayed for its presence. Detection of the marker virus consists of two major components, concentration and isolation of the marker virus, and detection of the marker virus. The concentration system involves adsorption of virus to cellulose acetate filters in the presence of trivalent cations and low pH with subsequent desorption of the virus using volumes of high pH buffer. The detection of the virus is performed by a passive immune agglutination test utilizing specially prepared polystyrene particles. An engineering preliminary design was performed as a parallel effort to the laboratory development of the marker virus test system. Engineering schematics and drawings of a fully functional laboratory prototype capable of zero-G operation are presented. The instrument consists of reagent pump/metering system, reagent storage containers, a filter concentrator, an incubation/detector system, and an electronic readout and control system. Author

N76-19783*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
BACTERIAL NITRATE REDUCTASES. 8: PRELIMINARY STUDY OF THE ENZYME OF MICROCOCCUS HALODENITRIFICANS
F. Pichinoty Washington NASA Mar. 1976 11 p refs Transl. into ENGLISH from Arc. Mikrobiol. (West Germany), v. 76, 1971 p 83-90
(Contract NASw-2789)
(NASA-TT-F-16933) Avail: NTIS HC $3.50 CSCL 06M

The biochemistry of the enzyme nitrate reductase A was studied. It was prepared in the form of a crude extract from bacterial cells (by centrifugation) and appeared to be in particulate form. The effects of various salts on the enzyme were studied. It is shown that the enzyme does not have a halophilic character, and 1 or .5 M NaCl, KCL, or CsCl do not activate it. However, IM MaCl activates the reduction of nitrate to nitrite by the crude cellular extract in the prescence of lactate as an electron donor. Results indicate that this effect is not due to an action of the salt on nitrate reductase. Results also show that enzyme biosynthesis is influenced by culture conditions, as anaerobic cultures containing nitrate form approximately 7 times more enzyme than aerobic cultures not containing nitrate. J.R.T.

N76-19784# Naval Medical Research Inst., Bethesda, Md.
A HYPERBARIC, CONSTANT-TEMPERATURE GROWTH SYSTEM SUITABLE FOR CULTIVATION OF MICROORGANISMS IN GASEOUS ENVIRONMENTS PRESSURIZED TO 1000 psig Medical Research Progress Report
R. Robertson and V. Frattali Mar. 1975 18 p refs
(AD-A015627; PR-4) Avail: NTIS CSCL 06/19

A description with general construction specifications is given for a system that allows the cultivation of microorganisms in a hyperbaric environment. Although designed primarily for use with helium-oxygen gas mixtures at a maximum pressure of 1,000 psig, other gas mixtures can be utilized at the maximum or at a lower pressure. The system incorporates water bath temperature control for maintaining the internal environment of a pressure vessel at any selected temperature within the range from -5 to 50C. A number of safety features have been incorporated for protection of the system and the system operator in the event of an inadvertent overpressurization. The system has built-in flexibility to allow use of various types and sizes of microbial culture vessels, and has the capability for being easily modified to accept probes to monitor internal temperature, pH of cultivation medium, concentrations of specific gases, and other factors. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-19785* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERAPEUTIC HAND EXERCISER Patent
Donald E. Barthlome, inventor (to NASA) Issued 10 Feb. 1976 7 p Filed 3 Jun. 1975 Supersedes N75-25539 (13 - 16, p 2013)
(NASA-Case-LAR-11667-1; US-Patent-3,937,215; US-Patent-Appl-SN-583487; US-Patent-Class-128-26; US-Patent-Class-128-DIG.20) Avail: US Patent Office CSCL 06B

A cyclic therapeutic hand exerciser based on inflation and deflation of structural members is described. A straightening and a bending motion is imparted to the fingers as air pressure inflates a splint-like upper member. The fingers are then straightened and upon deflation of the splint-like member and inflation of a wrist pouch a flap is tightened pulling the fingertips down and curling the fingers in toward the palm.
Official Gazette of the U.S. Patent Office

N76-19786*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT Annual Research Report, 1 Jan. - 31 Dec. 1975
U. C. Luft Feb. 1976 87 p refs
(Contract NAS9-14472)
(NASA-CR-147498) Avail: NTIS HC $5.00 CSCL 06P

Subjects were tested for tolerance to lower body negative pressure (LBNP) before and after acute dehydration by working intermittenly for two hours without fluid replacement. On the second day there-after the LBNP tests were repeated before and after acute dehydration. The LBNP test consisted of 5 min long consective stages at -20, -30, -40, -50 and -60 Torr. Tests were terminated when syncope was imminent or the full sequence was completed. Tolerance was expressed in terms of cumulative stress in Torr x min. Measurements of body mass, density, fat fraction and total body water (TBW) were made before and after acclimation. Blood volume and its constituents were determined before and after each of the four LBNP tests. During LBNP, heart rate, blood pressure, and changes in calf and forearm volume were recorded every minute. Results showed: acute dehydration caused a significant loss in average LBNP tolerance on all subjects. Acclimation to heat did not significantly affect LBNP tolerance in hydrated subjects but significantly improved it on dehydrated subjects. Author

N76-19787*# Scientific Translation Service, Santa Barbara, Calif.
INFLUENCES OF FOOD AND EXERCISE ON ENDOCRINE FUNCTIONS
Hoji Suzuki and Kazuo Takebe Washington NASA Feb. 1976 30 p refs Transl. into ENGLISH from Japan. J. Clin. Pathol. (Japan), v. 22, suppl. 1, Aug. 1974 p 102-115
(Contract NASw-2791)
(NASA-TT-F-16886) Avail: NTIS HC $4.00 CSCL 06P

Eating and exercise are investigated in terms of their influence on various endocrine functions by surveying recent findings. The tests employed are described, and methods are discussed which can cope with the factors having an influence. Author

N76-19788*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
TOTAL HIP ARTHROPLASTY MADE OF SINTERED ALUMINA. EXPERIMENTAL STUDY AND FIRST CLINICAL APPLICATIONS
P. Boutin Washington NASA Feb. 1976 27 p refs Transl. into ENGLISH from Rev. Chirurgie Orthopedique Reparatrice App. Moteur (Paris), v. 58, no. 3, 1972 p 229-246
(Contract NASw-2789)
(NASA-TT-F-16864) Avail: NTIS HC $4.00 CSCL 06B

A new material for making total hip prostheses is proposed. The tolerance of dense ceramics was studied, as well as the anchorage of this material to bone. The physical, chemical, and mechanical properties of the prosthesis were evaluated. Two hundred patients have already undergone hip prosthesis surgery, but not enough time has elapsed for meaningful conclusions to be drawn. Author

N76-19789# Advisory Group for Aerospace Research and Development, Paris (France).
THE USE OF IN-FLIGHT EVALUATION FOR THE ASSESSMENT OF AIRCREW FITNESS
Chester L. Ward, ed. (Army Med. Res. and Develop. Command, Washington, D. C.) Feb. 1976 70 p refs Presented at Aerospace Med. Panel Specialists Meeting, Ankara, 24 Oct. 1975
(AGARD-CP-182; ISBN-92-835-1208-1) Avail: NTIS

Various aspects of in-flight determinations of physical, psychological, physiological and bioaeronautical suitability and fitness of aircrew are presented. These include some in-flight and simulation techniques, examination methods, bioinstrumentation and procedures for fitness studies as well as results of assessment of the ability to fly safely with orthopedic injuries, amputations, and visual deficiencies, plus a few other physiolocial and psychological situations. Also included are assessments of paratroopers and nonpilot aircrew in their performance of duty. For individual titles, see N76-19790 through N76-19796.

N76-19790 Army Medical Research and Development Command, Washington, D.C.
US ARMY MEDICAL IN-FLIGHT EVALUATIONS, 1965-1975
Chester L. Ward, Nicholas F. Barreca (Brooke Army Med. Center, Ft. Sam Houston, Tex.), Robert J. Kreutzmann (Madigan Army Med. Center, Washington), David D. Glick (Army Aeromed. Res.

Lab., Fort Rucker, Ala.), and Morris A. Shamah *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 10 p refs (For availability see N76-19789 10-52)

The U.S. Army has recognized that the services of many experienced but medically disqualified aviators can be lost unless a method is established to comprehensively investigate an individual's adaptation and complete capability. Therefore one hundred thirty-two in-flight evaluations for a 10 year period (1965-1974) were reviewed. Information from the records and reports reposited at the U.S. Army Aeromedical Center, Fort Rucker, Alabama, was read, extracted and synthesized. Evaluation methods used, plus the results of compiling case classifications and the subsequent medical recommendations for duties involving flying are presented and discussed. Specific categories of individuals presented in detail are lower extremity amputees, 'one-eyed' aviators, and color vision defective aviators. Author

N76-19791 Civil Aeromedical Inst., Oklahoma City, Okla.
ACCIDENT EXPERIENCE OF CIVILIAN PILOTS WITH STATIC PHYSICAL DEFECTS
J. Robert Dille and Charles F. Booze *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 5 p refs (For availability see N76-19789 10-52)

The U.S. Federal Aviation Administration (FAA) is committed to establishment of airman physical standards and certification policies that are as liberal as possible compromising aviation safety. Throught the years, medical flight results, research, and consultant opinions have resulted in relaxation of medical standards and policies and current FAA certification of 4,704 pilots with blindness or absence of one eye, 14,421 who wear contact lenses, 15,779 with deficient color vision, 15,543 with deficient distant vision and smaller, but significant, numbers with paraplegia, deafness, and amputations. Limitations are placed on flying activities when appropriate. Routine aircraft accident investigations seek to determine the presence of physical problems in the involved airmen and any probable association of the defect with the accident cause. The FAA experience with these civilian pilots who have static physical defects is examined and accident rates were calculated for several categories of pathology for comparison with the overall accident rates in general aviation activities. Three categories show significant increases in accidents: (1) blindness or absence of one eye, (2) deficient color vision with a waiver, and (3) deficient distant vision. However, these groups reported much higher median flight times than a nonaccident airman population and accident airmen without any of the pathology selected for this study. Analyses of available data prove inconclusive but increased exposure may account for most or all of the increased accidents observed for airmen with these three pathologies. None of the accidents was related to the pilots' physical condition in the reports. Statistical biomedical data are given. Author

N76-19792 Italian Air Force Medical Appeal Board, Rome.
STRESS AND PSYCHIC FUNCTIONS: OPERATIONS OF FLIGHT CREWS AND PARATROOPS DURING PARACHUTE OPERATIONS
Luigi Longo *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 6 p refs (For availability see N76-19789 10-52)

Observations are presented which were made of the behavior of a considerable number of parachutists and flight crews during parachute operations. Such operations are marked by a series of phases or pre-arranged maneuvers which involve both the higher processes and simple motor mechanisms. A trained parachute officer and psychiatrist of the Italian Air Force studied the stresses which occur in the various phases and especially the involvement of the higher psychic processes. It appears that the emotive-affective complex is especially exposed to operational stress in this situation. Hypotheses are advanced on such issues as these, with special reference to the psychological content and to the effect of drill and discipline on stress. Author

N76-19793 Army Aeromedical Research Lab., Fort Rucker, Ala.
COMPARISON OF VISUAL PERFORMANCE OF MONOCULAR AND BINOCULAR AVIATORS DURING VFR HELICOPTER FLIGHT
Thomas L. Frezell and Mark A. Hofmann *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 9 p refs (For availability see N76-19789 10-52)

The inflight visual performance of six binocular Army aviators and one monocular Army aviator was assessed during various maneuvers in a JUH-1H helicopter. A corneal reflection technique using both video tape and 16mm film as a recording medium was employed. Information on the use of 13 visual sectors was provided for a number of maneuvers to include normal takeoffs and landings and hovering maneuvers. The aircraft windscreen was divided into eight sectors while the side windows and chin bubbles comprise an additional four sectors. The thriteenth visual sector represents the inside cockpit area. Data presented include percentage of total time spent in each sector, average dwell time per sector transition (permutation) values. Comparison data are provided between the six binocular pilots and the monocular pilot. These data reveal that in many cases there was little difference between binocular and monocular visual activity. In addition to the objectively recorded data, information concerning monocular visual cues is presented. Author

N76-19794 Army Aeromedical Research Lab., Fort Rucker, Ala.
HELICOPTER FLIGHT PERFORMANCE WITH THE AN/PVS-5, NIGHT VISION GOGGLES
Michael G. Sanders, Kent A. Kimball, Thomas L. Frezell, and Mark A. Hofmann *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 15 p refs (For availability see N76-19789 10-52)

Rotary wing flight at night in an instrumented UH-1H with aviators utilizing night vision goggles was studied. These devices restrict field of view, provide monochromatic imagery, and weight, and with the exception of bifocals require manual refocus to gain inside visual capability. These second generation image intensification systems were used during low level and nap-of-the-earth flight profiles in addition to various maneuver sets. Three intensification systems were compared to the unaided eye over these conditions. These systems included 40 deg field of view (FOV), 60 deg FOV and 40 deg FOV with a 30 percent bifocal cut. Over twenty aircraft state variables and aviator control inputs were measured and submitted to analysis. In addition to descriptive and univariate techniques, the data were subjected to a multiple discriminant analysis. The subjects (instructor pilots) also responded to questionnaires regarding the preference, training and estimated capabilities of each type of intensification system. The major findings of both the subjective and objective measures are summmarized. Author

N76-19795 Mainz Univ. (West Germany). Dept. of Physiology.
IN-FLIGHT LINEAR ACCELERATION AS A MEAN OF VESTIBULAR CREW EVALUATION AND HABITUATION
Rudolf J. VonBaumgarten *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 4 p refs (For availability see N76-19789 10-52)

Individual differences in susceptibility to motion sickness and in man's ability to habituate to vestibular stimuli was studied. It is proposed that individually oriented programs of vestibular testing (ground based) be supplemented by specific in-flight tests and in-flight habituation training for the following reasons: (1) the stimuli which cause vestibular airsickness in high performance aircraft at the shortest latency are rectilinear accelerations (otolithic-stimuli) of amplitudes, jerkloads and frequencies which cannot be simulated on the ground without enormous technical difficulties, and (2) the conventional ways of testing for motion sickness on the ground, involving coriolis-effects on rotating chairs, swings, caloric stimulation of the ears and centrifugation, do not simulate closely enough conditions of aircraft flight. It is suggested that special vestibular in-flight test and training regimens be used, based on individual traits. The test and habituation flights should include z-Axis acceleration between -1 and +2 g's, changes of rhythm of such stimulation, and alternation between threshold and sub-threshold maneuvers of opposite direction. Preliminary data obtained in a Lear-jet and in aerobatic light planes are examined and indicate that certain otolithic stimuli are very effective in producing motion sickness, and that habituation can be obtained against such stimuli.
Author

N76-19796 Ataturk Sanatorium, Ankara (Turkey).
EFFECT OF INCREASED ATMOSPHERIC ELECTRICITY ON THE BLOOD ELECTROLITES OF AIRPLANE CREW
Gultekin Caymaz *In* AGARD The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness Feb. 1976 5 p refs (For availability see N76-19789 10-52)

Airplane pilots during flights sometimes develop disorientation and fly in wrong directions with accidents resulting. It is proposed that the cause of disorientation or collapse in some of these cases may be the sudden changes in blood electrolites and acidity of the blood produced by increased atmospheric electricity. Experiments are described that were made on airplanes and their crews which show that the atmospheric electricity is higher inside the airplane than outside. Blood samples taken before and after flight show definite changes of acidity, electrolites and cholesterol. Atmospheric electricity was measured on a daily basis, and following high voltages, there were always increased amounts of traffic and airplane accidents. The study was conducted by the Turkish Air Force. Author

N76-19797*# Scientific Translation Service, Santa Barbara, Calif.
RELATIONSHIP BETWEEN WHOLE BODY AND LOCAL TOLERANCE TO COLD
Nobuo Yuza Washington NASA Mar. 1976 23 p refs Transl. into ENGLISH from "Zenshin Taikansei to Kyokusho Taikansei to no Kankei", Japan Air Self Defense Force, Aeromed. Lab., Japan. Reports, Tokyo, v. 14, Dec. 1973 p 147-160
(Contract NASw-2791)
(NASA-TT-F-16911) Avail: NTIS HC $3.50 CSCL 06S

An attempt was made to clarify the relationship between whole body tolerance to moderate cold and local tolerance to extreme cold in man. Healthy adult male volunteers were subjected to cold environments naked at 25 C, 20 C and 15 C in a climatic chamber for assessing whole body cold tolerance and to a point test for the middle finger in ice water for estimating resistance against frostbite. Author

N76-19798# Royal Aircraft Establishment, Farnborough (England).
MAXIMUM FORCES EXERTED BY MEN IN THE ZONE OF MOVEMENT OF THE ARMS AND LEGS
W. Rohmert Sep. 1975 35 p refs Transl. into ENGLISH from German report 1616
(RAE-Lib-Trans-1839; Rept-1616) Avail: NTIS HC $4.00

Maximum force measurements were carried out on five students, selected from a constitutional aspect, in the zone of movement of the arms in the six coordinate directions and for both rotational directions, as well as in the zone of movement of the legs as maximum foot forces in the plane of the symmetry of the body. The results are summarized in a biometric atlas. To illustrate, isodynes are plotted in the zone of movement. The accuracy of force measurements is discussed. In order to present the individual scatter in the position of the isodynes, the results are compared with earlier random investigations on a group of 60 students. Conclusions are drawn from the results and their practical and theoretical significance discussed. Author

N76-19799# Advisory Group for Aerospace Research and Development, Paris (France).
SPINAL INJURY AFTER EJECTION [LESIONS VERTEBRALES APRES EJECTION]
R. Auffret (Lab. de Med. Aerospatiale du Centre d'Essais en Vol de Bretigny sur Orge, France) and R. P. Delahaye (Hopital Militaire Begin, Saint Mande, France) 1975 59 p refs In FRENCH
(AGARD-AR-72(FR)) Avail: NTIS HC $4.50

Statistical data from seven NATO countries dealing with the frequency of fatalities, spinal fractures, and their distribution following ejection from aircraft was presented and analyzed. The relevant anatomical and physiological aspects were reviewed, followed by a discussion on the pathological mechanism of fractures. In most cases, it is difficult to determine whether the spinal fractures take place during the initial ejection or during the subsequent landing. Proper positioning of the pilot on the ejector seat is an essential requirement for a successful ejection. The radiological aspects of spinal fractures were described by distinguishing between stable and unstable fractures. The subsequent treatment and disability period were described. It is recommended that, following any ejection, a radiological examination of the entire spinal column should be completed. The strict aptitude requirements set by most air forces for combat aircraft pilots were discussed. See also N75-23150.
Transl. by Y.J.A.

N76-19800# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
HUMAN SENSORY FUNCTIONS. PART 1: VISUAL FUNCTIONS [ZINTUIGLIJKE FUNCTIES VAN DE MENS. DEEL 1: VISUELE FUNCTIES]
J. J. Vos 1974 35 p refs In DUTCH
(IZF-1974-24; TDCK-65450) Avail: NTIS HC $4.00

A contribution to a handbook on psychonomy relating to sensory functions is presented. The properties of the human eye are described, including optical image formation, image quality, the retina, photometry, light and dark adaptation, and color vision. ESA

N76-19801# Interuniversitair Reactor Instituut, Delft (Netherlands).
GONAD DOSAGE IN MALES RESULTING FROM X-RAY DIAGNOSTICS [GONADENDOSES BIJ MANNEN TENGEVOLGE VAN ROENTGENDIAGNOSTIEK]
J. A. Koen and C. J. Huyskens Mar. 1975 73 p refs In DUTCH
(IRI-190-75-05) Avail: NTIS HC $4.50

The Genetically Significant Dosage (GSD) resulting from X-ray diagnostics in Dutch hospitals was investigated. The frequency distribution of the dosage per patient was determined for eight X-ray diagnostic types which together produce about 90 % of the GSD. Some 6600 tests were carried out, and an estimate of 20 mrad was obtained for GSD in males. No correlation could be made between measured gonad dosage and the technical parameters of X-ray diagnostics. Some recommendations are made for possible further studies, which should result in suggestions for dosage-limiting measures. Author (ESA)

N76-19802# Army Medical Intelligence and Information Agency, Washington, D.C.
METHODS FOR STUDYING EFFECTS OF ENVIRONMENTAL STRESSES ON THE RESPIRATORY SYSTEM OF MAN
Pierre Varene and Henri Viellefond 6 Oct. 1975 11 p refs Transl. into ENGLISH from the book "Methodes D'Etude des Effets des Contraintes de L'Environnement sur le Systeme Respiratoire de L'Homme" France, Jan. 1973 p 469-472
(AD-A015889; MIIA-K-5925) Avail: NTIS CSCL 06/19

The report presents three stresses imposed by the environment on the thoracic-pulmonary apparatus of man. The stresses are modification of apparent weight, increase in density of ventilated gases and swift variation of ambient pressure. A detailed discussion of each stress and methods involved in determining the effects of the stresses are included. GRA

N76-19803# Army Medical Intelligence and Information Agency, Washington, D.C.
MECHANISM OF ADAPTATION OF THE ORGANISM TO HIGH-ALTITUDE HYPOXIA AND THE PROBLEM OF PROPHYLAXIS
F. Z. Meyerson 11 Sep. 1975 15 p refs Transl. into ENGLISH from Mono. Mekhanizm Adaptatsii Organizma k Vysotnoi Gipoksii i Prob. Profilaktiki (USSR), May - Jun. 1973 p 71-15
(AD-A015887; MIIA-K-5800) Avail: NTIS CSCL 06/19

The report presents the results of a study of the synthesis of DNA, RNA and protein in the nuclei and mitochondria of the heart during the adaptation to intermittent action of hypoxia. The adaptive value of mitochondrial biogenesis in hypoxia consists apparently in the following. The occurring oxygen deficiency lowers the formation of ATP in each mitochondrion. Accordingly, the formation of ATP per unit mass of tissue decreases as well. In response to this, there is activation in mitochondrial biogenesis, and the amount of these organelles per unit mass of tissue increases. Summing up, the functional disturbances which appear primarily as a result of ATP deficiency are abolished inspite of the persistent oxygen insufficiency and the decrease in the formation of ATP by each mitochondrion. Further development of the research concerned with studying the mechanism of adaptation to hypoxia and its prophylactic effects may apparently

play its own role in the elaboration of methods of prophylaxis and treatment of heart and brain diseases. GRA

N76-19804# California Univ., San Francisco. Biomechanics Lab.
SUMMATION OF HUMAN LOCOMOTION AND RELATED STUDIES Final Report, Jan. 1972 - Jun. 1975
V. T. Inman, H. D. Eberhart, and H. J. Ralston Sep. 1975 46 p refs Sponsored in part by HEW
(PB-245794/3; SRS-23-P-55835) Avail: NTIS HC $4.00 CSCL 06P

A major book, 'Human Walking,' summing up the work done at the Biomechanics Laboratory (and its predecessor projects) over the past 31 years, is being written. When complete, it will provide information on kinematics, including quantitative measurements of normal and abnormal gait, and kinetics, as well as energy transfers within the body, energy requirements during locomotion, the functions of the muscles, and the change that occur in certain disabilities and with loading of various parts of the body. The effects of surgical procedures and of certain appliances will be described. A monograph, 'The Joints of the Ankle,' by Verne T. Inman, is in press. This book, which deals primarily with the biomechanics of the ankle (talocrural) and subtalar (talocalcaneal) joints, rectifies many errors long perpetuated in the literature and offers pointers for clinical problems that have hitherto been inexplicable and have usually been solved on a trial-and-error basis. Author

N76-19805# Naval Medical Research Inst., Bethesda, Md.
THE VESTIBULAR APPARATUS UNDER WATER AND IN COMPRESSED GAS ENVIRONMENTS: ABSTRACTS OF TRANSLATED STUDIES Medical Research Progress Report
Robert S. Kennedy Feb. 1975 27 p refs
(AD-A015626; PR-1) Avail: NTIS CSCL 06/19

Twenty-two studies which contribute to understanding the role of the vestibular system under water and high pressure are abstracted in this report. Several aspects of vestibular function are included (e.g. decompression sickness, pressure vertigo, diver navigation, etc.). The studies were originally published in German (in one case Russian), but have been translated into English. Copies of the full translations are available on request from the author of this report. GRA

N76-19806# National Inst. for Occupational Safety and Health, Rockville, Md.
REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES, 1975 EDITION
H. E. Christensen, T. T. Luginbyhl, and B. Carroll Jun. 1975 1399 p refs Prepared by Tracor Jitco, Inc., Rockville, Md.
(Contract CDC-99-74-92)
(PB-246557/3; NIOSH-TSL-75) Avail: NTIS HC $41.75 CSCL 06T

The 1975 edition of the registry of Toxic Effects of Chemical Substances, formerly known as the NIOSH Toxic Substances List, is the fifth edition prepared in compliance with the requirements of the Occupational Safety and Health Act of 1970 (PL-91-596). This registry contains toxicity information on approximately 17,000 unique chemical substances along with about 48,000 synonyms. Information is given on route of entry, toxic dose and toxic effects including an indication of existing evidence of the substance may be carcinogen, mutagen, teratogen, etc. GRA

N76-19120* Avco-Everett Research Lab., Everett, Mass.
BLOOD FLOW
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 975-998 refs (For availability see N76-19059 10-02)
CSCL 06P

N76-19192* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT OF A BONE-FIXATION PROSTHETIC ATTACHMENT
Lester J. Owens *In its* 9th Aerospace Mech. Symp. Aug. 1975 p 281-293 (For availability see N76-19172 10-12)
CSCL 06B

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-19807# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE DEVELOPMENT OF A RASURA SELECTION TEST
C. L. Truijens 1974 14 p refs In DUTCH; ENGLISH summary
(Contract A69/KL/095)
(IZF-1974-18; TDCK-65380) Avail: NTIS HC $3.50

A selection test was constructed in the form of a strongly abbreviated auditive Doppler radar (RASURA) training course. The duration of this test is 45 min. By way of validation this test was administered to 105 trainees from the RASURA training center, before the actual training course. The most appropriate scoring method proved to be summation of all errors made during the test. With this scoring method the test validity, i.e., the correlation between performance in training and on the test, was $r = 0.633$. Some graphs are given by means of which a feasible choice can be made of a selection percentage and a selection threshold. Author (ESA)

N76-19808# Payne, Inc., Annapolis, Md.
LOW-SPEED AERODYNAMIC FORCES AND MOMENTS ACTING ON THE HUMAN BODY Final Report, 1 Nov. 1973 - 31 Jan. 1975
Peter R. Payne Jul. 1975 167 p refs
(Contract F33615-74-C-4015; AF Proj. 7231)
(AD-A015801; Working-Paper-119-9; AMRL-TR-75-6) Avail: NTIS CSCL 06/9

Information on the aerodynamic forces acting on the human body is sparse, and scattered in various hard-to-find reports. A primary purpose of this report is to collect the available data in one volume, and to present it in the most useful form. The aerodynamic force and moment data originally reported by Schmitt for three body positions is reported, together with additional data which he did not publish. The drag portion of the Schmitt data is then compared with all other available drag data, represented by wind tunnel tests with volunteer subjects and anthropomorphic dummies, and the instrumented free falls of parachutists and anthropomorphic dummies. GRA

N76-19809# Institute for Research, State College, Pa. Div. of Psychobiology.
BEHAVIORAL ENHANCEMENT Final Report, 1 Mar. 1973 - 31 Aug. 1975
Paul M. Hurst and Sallyann K. Bagley 31 Aug. 1975 18 p refs
(Contract N00014-73-C-0217)
(AD-A016250) Avail: NTIS CSCL 05/10

The principal goal in this 30-month period was to facilitate voluntary control over sleep. The initial phase employed analog tonal biofeedback of integrated submental EMG potential to facilitate relaxation. A pilot study was conducted in which EEG-determined Stage 2 sleep latency was compared within subjects between 'tone on' and 'tone off' conditions. This was followed by a controlled study in which one group of subjects received tonal biofeedback and the other did not. Neither study indicated any beneficial results from biofeedback on either relaxation or sleep latency. A third study was conducted in which a sedative-hypnotic drug (flurazepam) was used to evoke sleep in the attempt to achieve voluntary control of a classically conditioned response. Comparison of post-drug with pre-drug trials reveals a more rapid facilitation of sleep onset than would be expected on the basis of practice along, but does not conclusively demonstrate that classical conditioning was responsible. GRA

N76-19810# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPARATIVE ANALYSIS OF LEADERSHIP STYLES EXISTING IN SYSTEM PROGRAM OFFICES IN DIFFERENT PHASES OF THE WEAPON SYSTEM ACQUISITION LIFE CYCLE M.S. Thesis

Jerry W. Coggeshall and Juan G. Jasso Aug. 1975 119 p refs
(AD-A016265; SLSR-6-75B) Avail: NTIS CSCL 05/10

The leadership styles of managers and specialists working in United States Air Force weapon system program offices were examined in terms of the phases of the weapon system acquisition life cycle. The research population consisted of military and civilian managers and specialists working in thirteen weapon system program offices, each identified with a particular phase of the weapon system acquisition life cycle. For purposes of comparison, phases of the weapon system acquisition life cycle were grouped into conceptual/validation, full-scale development, and production/deployment categories. The Leadership Opinion Questionaire (LOQ), which measures leadership dimensions of consideration and structure, was the instrument through which data were obtained. Statistical analyses were based upon the LOQ scores of 182 respondents from the three categories: conceptual/validation - 22; full-scale development - 80; and production/deployment - 80. GRA

N76-19811# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPARATIVE ANALYSIS OF ORGANIZATIONAL CLIMATE EXISTING IN SYSTEM PROGRAM OFFICES IN DIFFERENT PHASES OF THE WEAPON SYSTEM ACQUISITION PROCESS M.S. Thesis
Julius C. Larson, Jr. and Peter J. Ruppert Aug. 1975 114 p refs
(AD-A016261; SLSR-1-75B) Avail: NTIS CSCL 05/10

Organizational climate is a relatively new concept that has come upon the social research scene. It can be conceptualized as the sum of all the different perceptions individuals in an organization have with respect to the organization. This study attempted to measure and assess the prevailing organizational climate in System Program Offices (SPOs) in different phases of the weapon system acquisition process. The researchers were interested in determining if organizational climate differed in different phases of weapon system acquisition. GRA

N76-19812# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.
QUANTITATIVE MODELLING OF THE TIME-MULTIPLEXING CHARACTERISTICS OF HUMAN CONTROLLERS Final Report
Tarald O. Kvalseth Aug. 1975 91 p refs
(Grant NSF GK-37419)
(PB-246339/6) Avail: NTIS HC $5.00 CSCL 05H

Theoretical model formulations and experimental data are presented for the input sampling or time-multiplexing characteristics of the human operator. An analysis is made of the uncertainty structure and the information processing during the sampling process; comparisons are made between the subjective and the objective uncertainty between sampling points. The effect of the cost structure on the sampling behavior was studied and an optimal dynamic sampling model was developed and tested. Studies one, two, and four involve pure monitoring tasks while the third one is based on a closed-loop control task. The displayed signals are all digital. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-19813*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH PRESSURE SPACE SUIT ASSEMBLY
Hubert C. Vykukal and Bruce W. Webbon Dec. 1975 20 p
(NASA-TM-X-62515; A-6393) Avail: NTIS HC $3.50 CSCL 06K

An effort is underway to incorporate advanced suit and LSS components into a functional suit in order to assess the performance of these components. A brief description of the suit configuration is presented. Author

N76-19814*# Transemantics, Inc., Washington, D.C.
SPACE PHARMACY
I. Fedorov NASA Mar. 1976 5 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 1, Jan. 1976 p 30
(Contract NASw-2792)
(NASA-TT-F-16964) Avail: NTIS HC $3.50 CSCL 06E

Functional disorders and illnesses which could occur during space flight are considered in terms of preparation of a first-aid kit. Contents of the kit are discussed as well as instructions and training in the use of the kit. Author

N76-19815*# Nelson and Johnson Engineering, Inc., Boulder, Colo.
CONCEPT DESIGN AND ALTERNATE ARRANGEMENTS OF ORBITER MID-DECK HABITABILITY FEATURES Final Report
Russell A. Church, John A. Ciciora, Kenneth L. Porter, and Grant E. Stevenson 30 Jan. 1976 210 p refs
(Contract NAS9-14686)
(NASA-CR-147495) Avail: NTIS HC $7.75 CSCL 05E

The evaluations and recommendations for habitability features in the space shuttle orbiter mid-deck are summarized. The orbiter mission plans, the mid-deck dimensions and baseline arrangements along with crew compliments and typical activities were defined. Female and male anthropometric data based on zero-g operations were also defined. Evaluations of baseline and alternate feasible concepts provided several recommendations which are discussed. Author

N76-19816*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PERCUTANEOUS CONNECTOR DEVICE Patent Application
Walter E. Parsons, inventor (to NASA) Filed 16 Sep. 1975 17 p
(NASA-Case-KSC-10849-1; US-Patent-Appl-SN-613734) Avail: NTIS HC $3.50 CSCL 06B

A percutaneous connector device for facilitating the passage of electrical signals from an external source through the skin of a patient to internal portions of the body such as muscles and nerves is described. The connector device includes a biocompatible shell having an enlarged disk shaped portion for being implanted below the skin of the patient. The shell has a first and second electrically conductive post upon which a plug means can be readily connected and disconnected. A modified form of the invention utilizes a unipolar connector that is adapted to be plugged into a shell implanted below the skin of a patient. Both of the connector devices are designed so as to be separated when a predetermined force is applied to the implanted bio-compatible shell. NASA

N76-19817# Systems Technology, Inc., Hawthorne, Calif.
MODELING BIODYNAMIC EFFECTS OF VIBRATION Interim Scientific Report
R. E. Magdaleno and R. W. Allen Jul. 1975 26 p refs
(Contract F44620-73-C-0075; AF Proj. 9777)
(AD-A015901; STI-TR-1037-2; AFOSR-75-1236TR) Avail: NTIS CSCL 06/19

Research during the year included refinement of a General Frequency Model Identification (GERMID) program so as to efficiently fit structural model parameters to data. Structural model refinements including a detailed neuromuscular actuation system model form based on applying the GERMID parameter identification program to some direct neuromuscular system describing function data previously gathered was initiated. Head motion data was reduced, interpreted and compared with head and eye motion data from the literature. Thus during the past two years the investigators have been engaged in determining the basic mechanisms of and models for vibration interference in pilot control tasks. Efforts in the next year will be to simplify some aspects of these component effects models and combine both visual and motor remnant models to give an overall performance model. GRA

N76-19818# Pennsylvania State Univ., University Park. Center for Air Environment Studies.
INFLUENCE OF ALTERED GASEOUS ENVIRONMENTS ON LUNG METABOLISM Annual Interim Progress Report, 1 Jul.

1974 - 30 Jun. 1975
Rodney A. Rhoades Jul. 1975 37 p refs
(Grant AF-AFOSR-2767-75; AF Proj. 9777)
(AD-A015914; AFOSR-75-1272TR) Avail: NTIS CSCL 06/19

The findings from this investigation indicated that 24h in vivo exposure to hyperoxia (100% oxygen) did not alter lung lipid synthesis but did alter lactate production and pyruvate metabolism. In vitro perfusion of lungs for 1.5h showed that direct exposure of lung to altered carbon dioxide tension does not produce edema. Moreover, direct exposure to altered carbon dioxide tension did not alter lipid synthetic capacity. Both lactate and pyruvate metabolism was altered with hypocapnia, while hypercapnia affected only pyruvate metabolism. Twenty four hour hypoxia significantly altered lung cyclic nucleotide levels. These data indicate that altered gaseous environments significantly change certain aspects of lung cellular activity and that changes in lactate and pyruvate metabolites may serve as sensitive indicators to lung dosage. GRA

N76-19119* Avco-Everett Research Lab., Everett, Mass.
ELEMENTARY THEORY OF SYNCHRONOUS ARTERIO-ARTERIAL BLOOD PUMPS
Robert T. Jones, Harry E. Petscheck, and Arthur R. Kantrowitz *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 967-973 (For availability see N76-19059 10-02)
(Contracts AF 49(638)-1657; PH-43-66-1131)
CSCL 06B

N76-19121* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUID DYNAMICS OF HEART ASSIST DEVICE
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 999-1017 refs Conf. paper presented at Specialists Meeting on Fluid Dynamics of Blood Circulation and Respirat. Flow, Naples, Italy, 4-6 May 1970 Sponsored in part by AFOSR (For availability see N76-19059 10-02)
CSCL 06B

N76-19174* Martin Marietta Corp., Denver, Colo.
A MANIPULATOR ARM FOR ZERO-g SIMULATIONS
Shepard B. Brodie, Christopher Grant, and Janos J. Lazar *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 19-29 (For availability see N76-19172 10-12)
CSCL 05H

N76-19181* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE PERFORMANCE OF COMPONENTS IN THE SKYLAB REFRIGERATION SYSTEM
Charles E. Daniher, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 115-131 refs (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 06K

N76-19183* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SKYLAB TRASH AIRLOCK
Larry R. Price *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 149-159 (For availability see N76-19172 10-12)
(Contract NAS9-6555)
CSCL 06K

N76-19190* Rensselaer Polytechnic Inst., Troy, N.Y.
MODERN MECHANISMS MAKE MANLESS MARTIAN MISSION MOBILE: SPIN-OFF SPELLS STAIRCLIMBING SELF-SUFFICIENCY FOR EARTHBOUND HANDICAPPED
George N. Sandor, David R. Hassel, and Philip F. Marino *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 247-263 refs (For availability see N76-19172 10-12)
(Grant NGL-33-018-091)
CSCL 05H

N76-19193* Rockwell International Corp., Downey, Calif.
A UNIQUE CHALLENGE: EMERGENCY EGRESS AND LIFE SUPPORT EQUIPMENT AT KSC
Henry M. Waddell, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 295-312 (For availability see N76-19172 10-12)
CSCL 06K

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N76-19819 Illinois Univ., Urbana.
TECHNIQUES FOR PARALLEL COMPUTER DESIGN Ph.D. Thesis
Paul Peter Budnik, Jr. 1975 273 p
Avail: Univ. Microfilms Order No. 76-6703

Various techniques for constructing parallel computers are reported. These techniques include the determination of a basic set of building block components, the establishment of interface and timing structures, and the development of techniques for pipelining and parallelizing complex control functions. The entire machine is broken up into small functional units which are independently queue driven. Dissert. Abstr.

N76-19820 Illinois Univ., Urbana.
A LIST MERGING PROCESSOR FOR INVERTED FILE INFORMATION RETRIEVAL SYSTEMS Ph.D. Thesis
Lee Allen Hollaar 1975 78 p
Avail: Univ. Microfilms Order No. 76-6801

In large scale inverted file information retrieval systems implemented on conventional digital computers, it is possible for more time to be spent processing and merging the index lists than on any other activity. A simple processor is described which can efficiently process these lists while the main computer devotes itself to other tasks. Designs for both word parallel and bit serial implementations of the merge processor are presented. The modifications necessary for these processors to be connected as a network and in particular to form a binary tree, along with algorithms for parsing expressions which can be contained in the available tree and which are too large and must be subdivided, are also discussed. Dissert. Abstr.

N76-19821*# Aeronutronic Ford Corp., Houston, Tex. Space Information Systems Operation.
ON-LINE MASS STORAGE SYSTEM FUNCTIONAL DESIGN DOCUMENT
D. Earnest Dec. 1975 75 p
(Contract NAS9-1261)
(NASA-CR-147490; JSC-10029) Avail: NTIS HC $4.50 CSCL 09B

A functional system definition for an on-line high density magnetic tape data storage system is provided. This system can be implemented in a multi-purpose, multi-host environment, and satisfy the requirements of economical data storage in the range of 2 to 50 billion bytes. Author

N76-19822# Naval Ship Research and Development Center, Bethesda, Md.

COMPUTER GRAPHICS BIBLIOGRAPHY

Jackie Potts Jan. 1975 119 p refs

(SF53532701)

(AD-A016827; DTNSRDC-4602) Avail: NTIS CSCL 09/2

This graphics bibliography covers the two major divisions of passive and interactive computer graphics. It includes graphics applications in such fields as analysis, architecture, computer-aided design, management, medicine, education, editing, manufacturing transportation, science, and others. It covers the years 1950 to the present. It contains approximately 1,000 references indexed by author, under the headings of applications, interactive, passive, potpourri, and software. GRA

N76-19823# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RATIONAL CONSTRUCTION OF MATHEMATICAL MODELS OF OBJECTS IN COMPUTER PROCESSING OF GEOMETRIC INFORMATION

D. M. Zozulevich 14 Apr. 1975 27 p refs Transl. into ENGLISH of the monograph "Vychislitelnaya Tekhnika v Mashinostroenii" Minsk, USSR, Inst. Tekhnicheskoy Kibernetiki, AN BSSR, Dec. 1970 p 3-16

(AD-A016136; FTD-HC-23-2703-74) Avail: NTIS CSCL 09/2

The paper analyzes the principal steps in computer processing of geometric information in the course of automatic or semiautomatic input, program analysis and synthesis and output to representation units. GRA

N76-19824# Inco, Inc., McLean, Va.

TOSS COMMON USER CAPABILITY Final Technical Report

Lelia Irby, Leon Marcus, Marianne Russek, and Karen Hsing Jul. 1975 27 p

(Contract F30602-74-C-0116; AF Proj. 4594)

(AD-A015762; RADC-TR-75-186) Avail: NTIS CSCL 09/2

The TOSS Common User Capability addresses the need to make user communication with large structured files of data as simple and logical as possible by providing interactive interface between the TOSS Information Management System (TIMS) and a user who is more familiar with his data base than he is with the mechanics of programming and file manipulation. The specific areas of data base management incorporated in the TOSS Common User Capability are file data definition, updating a data base, querying a data base, and generating formatted reports of file data. User language access to data management functions is primarily in the form of a simple dialogue conducted at his terminal, in which the user's commands and responses are prompted by the system. GRA

N76-19825# Navy Personnel Research and Development Center, San Diego, Calif.

A COMPARISON OF THREE COMBINATIONS OF TEXT AND GRAPHICS FOR CONCEPT LEARNING Technical Report, Jan. 1973 - Dec. 1974

William A. King Sep. 1975 23 p refs

(AD-A016805; NPRDC-TR-76-16) Avail: NTIS CSCL 09/2

A study was conducted to determine how verbal instruction could be supplemented by visuals, and in particular, how to take pedagogical advantage of the excellent capabilities of the PLATO 4 computer-based instructional system. Literature research disclosed little previous information of value on the subject. Three versions of a lesson on the sine-ratio concept were prepared, one with verbal text supplemented with animated graphics, one supplemented with still graphics, and one without graphics (text only). Forty-five students from the Basic Electricity/Electronics School at the Naval Training Center (NTC), San Diego, were randomly assigned to the three versions. A comparison of the pretest and posttest mean scores for each group revealed learning took place in each group, and a questionnaire administered after the posttest revealed that the students gave positive ratings to the instructional materials and presentations. The groups did not differ in time required for training. On the posttest, the animated graphics group had the highest mean performance, but none of the differences between groups were significant. It was concluded that these results are consistent with previous findings suggesting that graphics are more useful for teaching concepts involving time and motion than for concepts involving space, and more useful for tasks involving stimulus identification than for tasks involving terminology or comprehension. Author (GRA)

N76-19826# Research Inst. of National Defence, Stockholm (Sweden).

INTERACTIVE SOFTWARE FOR HUMANS

Jacob Palme Jul. 1975 58 p refs

(PB-245553/3; FOA-C-10029-M3(E5)) Avail: NTIS HC $4.50 CSCL 09B

Which are the human needs that are effected by the use of computers. How will computers affect the humans using them. What kinds of communications between humans will the computers cause. How can computer systems be designed to better satisfy human needs. What design principles should be used for such systems. What kinds of man-machine interaction will better satisfy human needs. These problems are discussed along with various methods. Computer driven, command driven and natural language interaction are discussed. GRA

N76-19827# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

PROGRAMMING LANGUAGE FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS USING HYBRID COMPUTERS, PHASE 1 Interim Report, Jul. 1973 - Jul. 1974

J. Thomas Broach and Robert M. McKechnie, III Mar. 1975 80 p ref

(DA Proj. 1E8-65803-M-730)

(AD-A017116; USAMERDC-2135) Avail: NTIS CSCL 12/1

The report covers the first phase of work intended to provide a hybrid-computer solution language for partial differential equations. The programming techniques and philosophy are discussed, and a sample problem solution is presented with details. This first attempt has been successful and provides a hybrid-computer scheme which is at least 50 times faster than the comparable purely digital approach. The program makes use of hybrid-computer graphics, with the input applied directly to the Tektronix 4010 Graphics Terminal and the solution curves presented to the graphics terminal on-line. GRA

N76-19828# Army Engineer Topographic Labs., Fort Belvoir, Va. Technology Development Branch.

ANALOG GRAPHIC PROCESSING FOR 3-D TERRAIN DISPLAYS, PROFILES, AND ELEVATION LAYER TINTS Research Note, Mar. - Apr. 1975

L. P. Murphy and E. G. Trelinskie, Jr. Oct. 1975 29 p refs (DA Proj. 4A7-62707-A-854)

(AD-A017493; ETL-0026) Avail: NTIS CSCL 09/2

This report briefly describes a computerized technique for transforming digital elevation data into gray-level-encoded film. This film is then used for near-real-time analog graphic (nondigital) processing for the display of terrain perspectives, profiles, and elevation layer tints. This report concludes that this approach offers considerable potential, at base and/or field levels, for producing special map graphics, displays, and analyzing terrain conditions for line-of-sight problems or nap-of-the-earth flight plans. Author (GRA)

N76-19829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HADES SYSTEM FOR COLLECTION AND TRANSFER OF DATA (DARO CELLATRON 1600)

P. Bartovsky 11 Mar. 1975 18 p Transl. into ENGLISH from Mechanizace, Automatizace Administrativy (Czechoslovakia), v. 14, no. 1, 1974 p 20-23

(AD-A017193; FTD-HC-23-0758-75) Avail: NTIS CSCL 09/2

The information system is described. Functional units including the input and output equipment of the terminal stations are discussed along with the data transfer between units. Applications of the system are given. F.O.S.

N76-19830# Stanford Univ., Calif. Computer Science Dept.
FINDING THE MAXIMAL INCIDENCE MATRIX OF A LARGE GRAPH
Michael Overton and Andrzej Proskurowski Sep. 1975 75 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402)
(AD-A017331; SU-STAN-CS-75-509) Avail: NTIS CSCL 09/2

The paper deals with the computation of two canonical representations of a graph. A computer program is presented which searches for 'the maximal incidence matrix' of a large connected graph without multiple edges or self-loops. The use of appropriate algorithms and data structures is discussed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-19831 Kansas State Univ., Manhattan.
DEVELOPMENT AND IMPLEMENTATION OF A CLASS OF MATRIX PRODUCT ALGORITHMS Ph.D. Thesis
Chi-Ching Chen 1975 103 p
Avail: Univ. Microfilms Order No. 76-2923

The problem wherein a given (m x n) matrix M is to be multiplied by a set consisting of a large number of vectors, an element of which is denoted by the (n x 1) vector X was considered. In such case, attempts are made to obtain a factorization for M, such that the total number of additions and multiplications required is less than that required to compute MX without factorization. To this end the problem is addressed by introducing a factorization method called the NSF (nonsingular submatrix factorization) algorithm. The NSF algorithm is applied to obtain factorizations for a variety of matrices which are used in signal processing applications. Further for such matrices it is demonstrated that the NSF algorithm can be used to obtain software implementations that could be more efficient than those currently used. Dissert. Abstr.

N76-19832 Oklahoma State Univ., Stillwater.
COMPILATION OF SEQUENTIAL PROGRAMS FOR PARALLEL EXECUTION Ph.D. Thesis
Otto Cleve Juelich 1975 161 p
Avail: Univ. Microfilms Order No. 76-3465

Techniques for the practically optimal compilation of a subclass of the class of acyclic programs for execution on an idealized parallel computer are derived. The computer has a single central processing unit controlling several arithmetic units. Each arithmetic unit can perform any of the computer's arithmetic instrumentions in one time quantum. An algorithm, called balanced assignment, is presented and is proved to be optimum for single expressions and for maxinal sequences of branch free code. The notion of the compound block is defined as the set of program statements dominated by some program statement. In loop free programs these compound blocks are proved to be nested like programming language blocks if and only if the program has a flow chart that is a series parallel network with two way branches and junctions. This property is named acyclic smooth and is independent of the programming language used, however acyclic smooth programming languages can be specified. Dissert. Abstr.

N76-19833*# Computer Sciences Corp., Falls Church, Va.
ANALYSIS AND APPLICATION OF MINIMUM VARIANCE DISCRETE TIME SYSTEM IDENTIFICATION
S. Kotob and H. Kaufman (Rensselaer Polytech. Inst.) Mar. 1976 23 p refs
(Grant NGR-33-018-183)
(NASA-CR-146498) Avail: NTIS HC $3.50 CSCL 09B

An on-line minimum variance parameter identifier was developed which embodies both accuracy and computational efficiency. The new formulation resulted in a linear estimation problem with both additive and multiplicative noise. The resulting filter is shown to utilize both the covariance of the parameter vector itself and the covariance of the error in identification. It is proven that the identification filter is mean square covergent and mean square consistent. The MV parameter identification scheme is then used to construct a stable state and parameter estimation algorithm. Author

N76-19834*# M&S Computing, Inc., Huntsville, Ala.
BANNING ARTWORK PROGRAM USER'S MANUAL Contractor Report
J. F. Taylor 19 Feb. 1976 85 p ref
(NASA-CR-144193) Avail: NTIS HC $15.00 CSCL 09B

A manual containing computer programs for designing circuits is presented. A description of the pattern library, the plotter used to draw the circuit patterns, and program control cards is given. Sample printouts and cards are shown. J.R.T.

N76-19835*# Colorado Univ., Boulder.
COMPUTER AUTOMATION FOR FEEDBACK SYSTEM DESIGN Semiannual Report
31 Dec. 1975 59 p
(Grant NsG-1140)
(NASA-CR-146638) Avail: NTIS HC $4.50 CSCL 09B

Mathematical techniques and explanations of various steps used by an automated computer program to design feedback systems are summarized. Special attention was given to refining the automatic evaluation suboptimal loop transmission and the translation of time to frequency domain specifications. E.H.W.

N76-19836*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN EXACT TRANSFORMATION FROM GEOCENTRIC TO GEODETIC COORDINATES FOR NONZERO ALTITUDES
David R. Hedgley, Jr. Mar. 1976 19 p refs
(NASA-TR-R-458; H-909) Avail: NTIS HC $3.50 CSCL 09B

An exact method for the nonzero altitude transformation from geocentric to geodetic coordinates is derived. The method is mathematically general and should serve as a primary standard. Author

N76-19837# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).
PRINTED CHARACTER LINEAR RECOGNITION SENSOR WITH AN INCOHERENT OPTICAL CORRELATOR [EIN LINEARER ERKENNER FUER GEDRUCKTE ZEICHEN MIT EINEM INKOHAERENT OPTISCHEN KORRELATOR]
S. Hosagasi Bonn DOKZENTBw 1974 95 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVG-FBWT-74-15) Avail: NTIS HC $5.00; DOKZENTBw DM 30

A simple cognitive sensor with a rather wide scope of applications was developed. Statistical theories of automatic pattern recognition were suitably simplified so that the necessary computations could be executed with the opto-electronic conversion of the picture by means of ordinary optical imaging. These cognitive sensors use the ordinary light originating from the object to compare its image with masks. Suitable measuring technology yields a low error rate. A device for recognition of typewriter numerals is described, yielding an average error rate of one in a million. Besides its potential application for data acquisition, the device demonstrated its power for other suitable tasks. Author (ESA)

N76-19838# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).
EFFECT OF COMPUTATION ACCURACY, CHARACTER NORMALIZATION AND CONTEXT ON RECOGNITION OF HANDWRITTEN CHARACTERS WITH A LOEVE-KARHUNEN SERIES [EINFLUSS VON RECHENGENAUIGKEIT, ZEICHENNORMIERUNG UND KONTEXT BEI DER ERKENNUNG HANDGESCHRIEBENER ZEICHEN MIT LOEVE-KARHUNEN ENTWICKLUNG]
A. Guedesen Bonn DOKZENTBw 1974 116 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVG-FBWT-74-16) Avail: NTIS HC $5.50; DOKZENTBw DM 40

A recognition system dealing with handprinted alphanumeri-

cal characters was developed. Automatic reading of logistical or FORTRAN command sheets at sufficient reliability was the main goal of the work. An investigation on the computational accuracy for carrying out the recognition algorithms is presented. Estimations from error analysis as known from the literature were compared with those from practical results. It turns out that a computational word length of 11 bit leads to an additional calculation error which is sufficiently low. So, simple and cheap minicomputers may be used for the implementation of the whole recognition procedure. In order to obtain better recognition results, character normalizations were investigated. Before the recognition started, characters were preprocessed by different procedures such as local operations, centering, rotating, shearing, stroke width, and size normalization. These methods lead to a reduction in error rate by a factor of three. None of the other methods has yet been tested. The use of context was studied from the literature in order to gain further reduction of classification error rate. Methods are reported to obtain better results at certain types of grouping characters or by using certain 'languages' (e.g. FORTRAN). Author (ESA)

N76-19839# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).

ATTEMPT TO REDUCE THE CLASSIFICATION TASK FOR HANDWRITTEN CHARACTER RECOGNITION BY ADEQUATE PREPROCESSING [EIN VERSUCH, DEN KLASSIFIKATIONSAUFWAND FUER DIE ERKENNUNG HANDGESCHRIEBENER ZIFFERN DURCH EINE GEEIGNETE VORVERARBEITUNG ZU VERMINDERN]

D. Paul Bonn DOKZENTBw 1974 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVG-FBWT-74-17) Avail: NTIS HC $4.00; DOKZENTBw DM 20

A new preprocessing procedure was applied to an existing character recognition system. This procedure is expected to reduce classification costs. The character recognition system works as follows: the handprinted characters are taken into a grid and normalized with respect to height. The rows of the grid are then concatenated forming a pattern-vector with binary grey values as elements. This vector is expanded into a modified Loeve-Karhunen series. The character is classified by means of the Bayes decision-rule using the N first coefficients of the series expansion. The classification procedure takes by far the most computing time which increases by sqN. The investigated preprocessing procedure constructs the skeleton-line of the character and describes the character by the orientation of line elements as a function of line-length. The elements of the resulting pattern vector are orientations of line elements. The vector is invariant with respect to size and line width. Furthermore, the parametric representation of the character forms a smooth curve. Due to this property the series expansion is expected to converge faster. The effect of two kinds of preprocessing was compared using a sample set of handprinted digits. Author (ESA)

N76-19840# Data Use and Access Labs., Arlington, Va.

CENTS-AID 2, PROGRAMMER'S NOTEBOOK

Gary Hill Sep. 1975 15 p

(Contract PHS-72-2707)

(PB-245861/0) Avail: NTIS HC $3.50 CSCL 05K

The document outlines and explains the eleven step system execution of the CENTS-AID 2 programming module. The CENTS-AID is a generative system in that it generates a COBOL computer program in response to user supplied commands, which will then process the input data and file and print the requested reports. GRA

N76-19841# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.

MACHINERY SIMULATION FACILITY USER'S GUIDE TO ANALOG/HYBRID COMPUTER SCALING TECHNIQUES

D. Baker Oct. 1975 43 p refs

(AD-A016239; PAS-75-33) Avail: NTIS CSCL 09/2

Basic scaling techniques and procedures for analog computers are presented and explained. Different procedures are compared. Scaling techniques for various nonlinear units are discussed. Scaling techniques for taking maximum advantage of the digital portion of the hybrid computer in setting up analog problems or the analog portion of hybrid problems are presented. GRA

N76-19842# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Studies.

THE IMPROVEMENT AND INDIVIDUALIZATION OF COMPUTER-ASSISTED INSTRUCTION Final Report, 1 Aug. 1970 - 31 Jul. 1975

Marian Beard, Avron Barr, Dexter Fletcher, and Richard C. Atkinson 15 Sep. 1975 37 p refs

(Contract N00014-67-A-0112-0054; ARPA Order 2284; NR Proj. 154-326; RR0420000)

(AD-A015702) Avail: NTIS CSCL 05/9

The report summarizes research on the improvement and individualization of instruction, with reference to a theoretical framework of optimization, and specific applications in computer-assisted instruction (CAI). Two projects involved the acquisition of foreign-language vocabulary items. Experiments with Spanish and Russian items showed that the method could be a powerful aid in building and retaining a large vocabulary of foreign words. Two CAI courses in computer programming were developed. The first provided instruction and practice in the Algebraic Interpretive Dialogue (AID) language, and was used to investigate various optimization and individualization techniques, on the level of single problems as well as over entire lessons. The BASIC Instructional Program (BIP) was developed as a vehicle for CAI research in optimal selection of instructional material by means of an internally stored curriculum description and a model reflecting the student's changing state of knowledge. Each project is discussed briefly, with references to the publications that describe the research in detail. GRA

N76-19843# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

PATH EXPRESSIONS

A. N. Habermann Jun. 1975 39 p

(Contract F44620-73-C-0074; Grant NSF DRC-74-24573; DARPA Order 2466)

(AD-A015842; AFOSR-75-1292TR) Avail: NTIS CSCL 09/2

Traditionally, synchronization of concurrent processes is coded in line by operations on semaphores or similar objects. Path expressions move the responsibility of implementing such restrictions from the programmer to a compiler. The programmer specifies as part of a type definition which execution sequences are permitted. The advantage of using path expressions instead of P,V operations on semaphores (or similar operations) is comparable to the advantage of using for- and while-statements instead of JUMP or BRANCH instructions. In this paper the rules for writing a path expression are described, parsing and implementation are discussed and the use of path expressions is shown by a number of examples. GRA

N76-19844# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

MULTIPROCESS SOFTWARE ARCHITECTURE FOR AI PROBLEM SOLVING

Richard Dean Fennell May 1975 200 p refs

(Contract F44620-73-C-0074)

(AD-A015845; AFOSR-75-1313TR) Avail: NTIS CSCL 09/2

This dissertation describes the design and development of a knowledge-based artificial intelligence problem-solving organization that is suitable for efficient implementation on a closely-coupled multiprocessor computer system. The method is a result of formulating the problem-solving organization in terms of the hypothesize-and-test paradigm for heuristic search, with communication between the various hypothesizers and testers being effected by writing intermediate results in a shared blackboard-like data base. These hypothesizers and testers are expressed in terms of knowledge sources which represent bodies of suitably ortanized subject-matter knowledge pertinent to the task domain of the problem being solved. The various system organization problems connected with such a multiprocessing scheme are discussed, and solutions to these problems are presented. The major contributions of this work lie in the analysis and solution of the various multiprocessing problems that have arisen in the course of specifying this problem-solving organization. GRA

N76-19845# Desmatics, Inc., State College, Pa.

AUTOMATED RESPONSE SURFACE METHODOLOGY IN DIGITAL COMPUTER SIMULATION. VOLUME 1: PRO-

GRAM DESCRIPTION AND USER'S GUIDE
Dennis E. Smith Sep. 1975 101 p refs
(Contract N00014-74-C-0148; NR Proj. 277-100)
(AD-A016286; TR-101-1) Avail: NTIS CSCL 09/2

A modular computer program based on the statistical techniques of Response Surface Methodology has been developed to conduct the task of seeking optimum solutions to problems being simulated on a digital computer. The program, which may be used for constrained or unconstrained optimum-seeking in conjunction with deterministic or Monte Carlo simulations, is now available to potential users. This report volume describes the program and serves as a user's guide. A second volume contains program flowcharts and listings. GRA

N76-19846# Michigan Univ., Ann Arbor.
USER REQUIREMENTS LANGUAGE (URL) USER'S MANUAL
Henry J. Eiden and Charles R. Moore Mar. 1975 226 p
(Contract F19628-74-C-0171; AF Proj. E189)
(AD-A015748; ESD-TR-75-88-Vol-2) Avail: NTIS CSCL 09/2

The User Requirements Language (URL) is one of two major components of computer aided requirements analysis. URL is a machine processable language that appears very much like English. Its precision facilitates machine storage of requirements data while its natural language appearance facilitates use by non-computer experts. The language provides a medium within which functional and performance requirements of information systems can be expressed in a standard way, more easily analyzed, and compared between systems. URL is meant to be used conjunction with the User Requirements Analyzer described in ESD-TR-75-88, Vol. 3. Author (GRA)

N76-19847# New York Univ., Bronx. Computer Research Lab.
SYNTHESIS, A PROGRAM FOR GENERATING PICTURES
Margaret E. Kepner Jul. 1975 126 p refs
(Contract N00014-75-C-0572; NR Proj. 049-274)
(AD-A016653; CRL-41) Avail: NTIS CSCL 09/2

SYNTHESIS, an experimental program for the generation of pictures based on linguistic models, is described. This program allows a user to specify a picture grammar interactively and to display the associated picture elements. The program execution and organization are explained, and the data structure is presented. Some of the strengths and weaknesses of SYNTHESIS are discussed and directions of possible expansion are suggested. GRA

N76-19848# Naval Research Lab., Washington, D.C.
AN/UYK-17 (XB-1) (V) SIGNAL PROCESSING ELEMENT MICROPROGRAMMING SUPPORT SOFTWARE Interim Report
Tomlinson G. Rauscher, John D. Roberts, Jr., and W. David Elliott 10 Oct. 1975 127 p refs
(AD-A016806; NRL-7777) Avail: NTIS CSCL 09/2

The AN/UYK-17 Signal Processing Element (SPE) is being developed at the Naval Research Laboratory to provide a high performance processing facility for radar, sonar, and communications systems. The design of the microprogrammable SPE enables realization of efficient, flexible solutions to problems that arise in digital signal processing tasks. The SPE is intended to be compatible with the Navy All Applications Digital Computer (AADC) now under development, and it is intended to be implemented as part of the AADC system. The SPE can also be used as a stand-alone processor. GRA

N76-19849# Naval Postgraduate School, Monterey, Calif.
SYSTEM TEST METHODOLOGY, VOLUME 2
G. H. Bradley, G. T. Howard, N. F. Schneidewind, G. W. Montgomery, and T. F. Green Jul. 1975 92 p refs
(AD-A016781; NPS-55SS75072B-Vol-2) Avail: NTIS CSCL 09/2

The report continues with Part 2 of the system test methodology including the following: Description of prototype testing simulation model; FORTRAN example program code; Directions for the use of the error simulation program; Error simulation program listing; Directions for the use of the analytical error detection model. GRA

N76-19850# Desmatics, Inc., State College, Pa.
AUTOMATED RESPONSE SURFACE METHODOLOGY IN DIGITAL COMPUTER SIMULATION. VOLUME 2: PROGRAM FLOWCHARTS AND LISTINGS
Dennis E. Smith Sep. 1975 86 p ref
(Contract N00014-74-C-0148; NR Proj. 277-100)
(AD-A016387; TR-101-2) Avail: NTIS CSCL 09/2

One variant of the finite element method is presented as applicable for calculations of the reinforced thin-walled structures (flat and curved panels, wings and empennage of different schemes, fuselage sections). The applicability of the method coupled with a computer programming is illustrated by several actual calculations. Theoretical results are compared with experimental data. GRA

N76-19851# Stanford Research Inst., Menlo Park, Calif.
ON THE FEASIBILITY OF SOFTWARE CERTIFICATION Final Report
Ralph E. Keirstead Jun. 1975 161 p refs
(Grant NSF GJ-36903; SRI Proj. 2385)
(PB-245213/4) Avail: NTIS HC $6.75 CSCL 09B

Some of the factors that lead to and inhibit the establishment of a formal certification service are examined. Emphasis is focused on identifying the key issues that must be resolved to make certification feasible rather than on how such a service may function. It is indicated that, at present, software certification is not feasible. The reason, however, is not that it is impossible to devise methods for assessing software or that the tools for such an examination are unavailable but, rather, that there is a lack of generally accepted standards by which to measure software quality. GRA

N76-19852# Research Inst. of National Defence, Stockholm (Sweden).
DECSYSTEM-10 SIMULA GAZETTE, NO. 2, VOLUME 1
Jacob Palme Aug. 1975 21 p
(PB-245955/0) Avail: NTIS HC $3.50 CSCL 09B

The SIMULA maintenance group at the Swedish National Defense Research Institute and the Swedish software house ENEA have prepared release 2 of DEC system-10 SIMULA. Release 2 contains a number of useful improvements, which are described. GRA

N76-19853# National Institutes of Health, Bethesda, Md. Software Support Section/Data Management Branch.
PROJECT RMAG, LOGIC SUBROUTINES. USER'S GUIDE
Robert A. Magnuson Oct. 1975 90 p refs
(PB-246204/2; NIH-DCRT-DMB-SSS-AN503) Avail: NTIS HC $5.00 CSCL 09B

An interrelated set of subroutines constituting a canned logic package is announced. With these routines a schema containing single-letter atoms, any combination of five connectives, nested parentheses, (Church's) dots, and arbitrary spacing between elements is transformed to a minimized disjunctive normal form. Additionally, the caller is told whether the input schema is inconsistent, tautologous, or ill-formed. The user can determine the truth of schemata with respect (say) to the record currently in memory--thus deciding whether to retrieve this record according to potentially complex criteria. The user can generate reentrant code corresponding to schemata. GRA

N76-19854# National Bureau of Standards, Washington, D.C.
COBOL
Mabel V. Vickers 1 Dec. 1975 8 p Supersedes FIPS-PUB-21 and COM-72-50348
(PB-246438/6; FIPS-PUB-21-1; FIPS-PUB-21; COM-72-50348) Avail: NTIS HC $3.50 CSCL 09B

This FIPS PUB announces the adoption of the American National Standard COBOL (X3.231974) as the Federal Standard COBOL. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL programming language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems. The COBOL language is intended for

use in computer applications that emphasize the manipulation of characters, records, and files. GRA

N76-19855# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 4: DATA STRUCTURING STUDY Final Technical Report
John T. Trimble 21 Apr. 1975 50 p refs
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A015794; RADC-TR-74-300-Vol-4) Avail: NTIS CSCL 09/2

This report contains the results of a survey of the technical literature in the area of data definition, data flow, and data handling together with descriptions of techniques and mechanisms for resolving some of the problems in these areas. The techniques and mechanisms described are fully compatible with top down structured programming and can be used in conjunction with the Programming Support Library, described in Volume V and VI of the Structured Programming Series. GRA

N76-19856# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 14: SOFTWARE TOOL IMPACT Final Report
Marvin M. Kessler and William E. Kister 22 May 1975 33 p
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A015795; RADC-TR-74-300-Vol-14) Avail: NTIS CSCL 09/2

This report contains an assessment of the impact of a structured programming precompiler on software tools used in support of a programming project. Use of the precompiler in both the program development and program operational phases is addressed. A projection of how structured programming will affect future software tool development is also included. GRA

N76-19857# Stanford Univ., Calif. Dept. of Computer Science.
SOME LINEAR PROGRAMMING ASPECTS OF COMBINATORICS
V. Chvatal Sep. 1975 33 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402)
(AD-A017053; SU-STAN-CS-75-505) Avail: NTIS CSCL 12/2

This is the text of a lecture given at the Conference on Algebraic Aspects of Combinatorics at the University of Toronto in January, 1975. The lecture was expository, aimed at an audience with no previous knowledge of linear programming. GRA

N76-19858# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ESZTER PROGRAM FAMILY
Geza Allo 3 Mar. 1975 24 p Transl. into ENGLISH from Hiradastechnika (Hungary), v. 25, no. 2; Feb. 1974 p 33-38
(AD-A017192; FTD-HC-23-0617-75) Avail: NTIS CSCL 09/2

Designing digital equipment for automation, and the advantages of including computers in the designing process are discussed. Steps of computerized constructional designing, and the operation of ESZTER are described. F.O.S.

N76-19859# Stanford Univ., Calif. Dept. of Computer Science.
SOFTWARE IMPLEMENTATION OF A NEW METHOD OF COMBINATORIAL HASHING
Pierre Dubost and Jean-Michel Trousse Sep. 1975 38 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402)
(AD-A017294; SU-STAN-CS-75-511) Avail: NTIS CSCL 09/2

This is a study of the software implementation of a new method of searching with retrieval on secondary keys. A new family of partial match file designs is presented, the worst case is determined, a detailed algorithm and program are given and the average execution time is studied. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N76-19860# Army Engineer Topographic Labs., Fort Belvoir, Va.
OPTICAL POWER SPECTRUM ANALYSIS (OPSA): RECORDING OPTICAL SPECTRUM ANALYZER SYSTEM HARDWARE
Robert D. Leighty May 1975 25 p
(DA Proj. 4A7-62707-D-853)
(AD-A016131; ETL-TR-74-11; Rept-1) Avail: NTIS CSCL 09/2

The optical spectrum analyzer hardware used in pattern recognition research at the Research Institute, U.S. Army Engineer Topographic Laboratories, is discussed in detail. This system involves detection of signals by a segmented spatial frequency plane detector in a coherent optical system when selected portions of an aerial image are illuminated. These signals are then electronically processed and formatted for digital computer processing with pattern recognition software. It is anticipated that the system will lead to applications for automated information extraction from aerial imagery which include cloud screening, extraction of selected planimetric information, image quality analysis, and techniques for automated selection of image preprocessing requirements. GRA

N76-19861# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENT OPTIMIZATION Ph.D. Thesis
Harold D. Shoemaker Jun. 1975 100 p refs
(AD-A017219; DS/EE/75-2) Avail: NTIS CSCL 12/1

In this paper a methodology is developed for determining the optimum measurement strategy for processes which can be represented by linear, discrete plant and measurement equations. The optimum values of the observation matrices are determined by minimizing a cost function which contains a quadratic form of the observation matrices. The class of problems considered is referred to as combined optimization problems whose solution requires the determination of the best estimate of the state, the optimum plant control and the optimum observation control. The plant equation is linear in the state and plant control, and contains an additive white Gaussian noise term. The cost function to be minimized is quadratic in the state and plant control, and contains a scalar valued quadratic form of the observation matrix. GRA

N76-19862# Illinois Univ., Urbana. Coordinated Science Lab.
LINEAR PROGRAMMING WITH THE METHOD OF MULTIPLIERS
Lawrence Edward Berman Aug. 1975 57 p refs
(Contract DAAB07-72-C-0259)
(AD-A017304; R-686; UILU-ENG-75-2221) Avail: NTIS CSCL 12/2

In this thesis it is shown that the method of multipliers, a technique for nonlinear programming, can be used to solve linear programs in a finite number of steps. A computational procedure is developed with particular attention paid to linear optimal control problems. The results of some computational experiments are reported. GRA

N76-19863# Illinois Univ., Urbana. Coordinated Science Lab.
SEPARATION OF TIME SCALES IN LINEAR TIME-INVARIANT SYSTEMS
Joe Hong Chow Sep. 1975 80 p refs
(Contract DAAB07-72-C-0259; Grants AF-AFOSR-2570-73;

NSF ENG-74-20091)
(AD-A017301; R-688) Avail: NTIS CSCL 12/1

The approach taken in this thesis is to decouple a two-time-scale system into a slow subsystem and a fast subsystem. Then an approximate solution to a control problem for the complete system is obtained by solving two lower order subsystem control problems. The advantage of this approach is that it provides a better insight into the system structure than the approaches in past work. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-19864 Illinois Univ., Urbana.
VERTICES OF REPRESENTATIONS OF FINITE GROUPS Ph.D. Thesis
Gerald Howard Cliff 1975 79 p
Avail: Univ. Microfilms Order No. 76-6726

Let G be a finite p-solvable group, and k a field of characteristic p which is a splitting field for G and all of its subgroups. A module-theoretic proof is presented of Fong's theory of blocks of kG. Data show that Fong's correspondences hold for indecomposable representations, as well as for irreducible ones, and that vertices are preserved. These results are used to show that if an irreducible kG-module belonging to a block B has a cyclic vertex, then this vertex is the defect group of the block B. Results are proved which give the p-part of the dimension of an indecomposable kG-module M in terms of the vertex of M. Let R be a complete discrete valuation ring with maximal ideal P. An R-representation is constructed of a T of a cyclic p-group such that T has different vertices with reduced modulo P and P sq. Dissert. Abstr.

N76-19865*# Scientific Translation Service, Santa Barbara, Calif.
ON THE PROBLEM OF EQUATIONS OF FIXED TYPE
W. A. Bizadse Washington NASA Mar. 1976 79 p refs Transl. into ENGLISH of the book "Zum Problem der Gleichungen vom Gemischten Typus" Berlin, VEB Ger. Sci. Publishing House, 1957 p 1-59 Original in RUSSIAN
(Contract NASw-2791)
(NASA-TT-F-16903) Avail: NTIS HC $5.00 CSCL 12A

Mixed elliptical and hyperbolic differential equations encountered in gas dynamics are discussed. Two types of boundary value problems are considered, the boundary value problem T and the boundary value M. The T problem is broken down into several special problems, according to how the boundary values are specified. Author

N76-19866# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINING THE NATURAL FREQUENCIES OF SPHEROIDS VIA THE BOUNDARY-VALUE PROBLEM FORMULATION
R. J. Lytle and F. J. Deadrick 25 Apr. 1975 21 p refs
(Contract W-7405-eng-48)
(UCRL-51794) Avail: NTIS HC $4.25

Equations by which one can determine the natural frequencies of prolate and oblate spheroids are derived by using the boundary-value-problem approach. Both transvers magnetic and transverse electric excitations are considered. Numerical results are given for the natural frequencies of transverse-magnetic-excited prolate spheroids with various eccentricities, demonstrating natural mode dependence on eccentricity. Numerical difficulties, however, precluded obtaining natural frequencies for oblate spheroids, transverse-electric-excited prolate spheroids, and transverse-magnetic-excited prolate spheroids with sheaths. Author (NSA)

N76-19867# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
ON NUMERICAL ERRORS IN THE FINITE ELEMENT METHOD
J. H. Argyris, T. L. Johnsen, R. A. Rosanoff, and J. R. Roy 1975 40 p refs
(ISD-177) Avail: NTIS HC $4.00

Various sources of errors, physical and numerical, in the finite element method were analyzed. A new type of iterative improvement was introduced in which the residual was calculated in single precision. The iteration scheme was analyzed with respect to round-off errors and found to give significant improvement over existing direct approaches. Author (ESA)

N76-19868# California Univ., Berkeley.
A RECURRENCE AMONG THE ELEMENTS OF FUNCTIONS OF TRIANGULAR MATRICES Final Report
B. N. Parlett May 1975 10 p refs
(Contract N00014-69-A-0200-1017)
(AD-A016635; X-667) Avail: NTIS CSCL 12/1

A simple relation exists among the elements of Phi(T) when Phi is an analytic function and T is triangular. This permits the rapid build up of Phi(T) from its diagonal. Moreover exp(B(-1)A) can be formed without inverting B. GRA

N76-19869# Florida State Univ., Tallahassee. Dept. of Statistics.
FUNCTIONS DECREASING IN TRANSPOSITION AND THEIR APPLICATIONS IN RANKING PROBLEMS Interim Report
Myles Hollander, Frank Proschan, and Jayaram Sethuraman Oct. 1975 29 p refs
(Grants AF-AFOSR-2581-74; DAHC04-74-G-0188; AF Proj. 9769)
(AD-A017635; AFOSR-75-1548TR) Avail: NTIS CSCL 12/1

Many well known multivariate densities have the DT(Decreasing in Transposition). This paper develops many of the basic properties of DT functions, derives their preservation properties under mixtures, compositions, integral transformations, etc. A number of applications are then made to problems involving rank statistics. GRA

N76-19870# Kent State Univ., Ohio. Dept. of Mathematics.
ON RECURRING THEOREMS ON DIAGONAL DOMINANCE Interim Report
R. S. Varga 1975 14 p refs
(Grants AF-AFOSR-2729-74; E(11-1)-2075; AF Proj. 9749)
(AD-A017614; AFOSR-75-1512TR) Avail: NTIS CSCL 12/1

The elementary, but very useful concept of a strictly diagonally dominant n x n complex matrix has seen various generalizations over the course of years. The primary purpose of this note is to give a number of equivalent conditions which reproduce, and in some cases strengthen, many consequences of recent generalizations of the property of diagonal dominance. GRA

N76-19871# Kent State Univ., Ohio. Dept. of Mathematics.
ZERO-FREE PARABOLIC REGIONS FOR SEQUENCES OF POLYNOMIALS Interim Report
E. B. Saff and R. S. Varga 1975 31 p refs Prepared in cooperation with Univ. of South Florida
(Contract AT(11-1)-2075; Grant AF-AFOSR-2729-74)
(AD-A017619; AFOSR-75-1515TR) Avail: NTIS CSCL 12/1

The purpose of the present paper is to establish the existence of zero-free parabolic regions for certain general sequences of polynomials. GRA

N76-19872# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
MOMENT FORMULAS FOR THE MARKOV RENEWAL BRANCHING PROCESS Interim Report
Marcel F. Neuts Sep. 1975 37 p refs
(Grant AF-AFOSR-2350-72; AF Proj. 9769)
(AD-A017615; AFOSR-75-1516TR) Avail: NTIS CSCL 12/2

There are many queueing models in which there appears a semi-Markov matrix G(.), whose entries are absorption time distributions in a Markov renewal branching process. The role of G(.) is similar to that of the busy period in the simple M/G/1 model. The computation of various quantities associated with G(.) is however much more complicated. The moment matrices, and particularly the mean matrix of G(.), are essential in the construction of general and mathematically well-justified algorithms for the steady-state distributions of such queues. This paper discusses the moment matrices of G(.) and algorithms for their numerical computation. Its contents are basic to the

algorithmic solutions to several queueing models, which are to be presented in follow-up papers. GRA

N76-19873# University of South Florida, Tampa. Dept. of Mathematics.
GEOMETRIC CONVERGENCE TO e TO THE MINUS Z POWER FUNCTIONS WITH REAL ROLES Interim Report
E. B. Saff, A. Schonhage, and R. S. Varga 1975 26 p refs
(Grants AF-AFOSR-2688-74; E(11-1)-2075; AF Proj. 9749)
(AD-A017628; AFOSR-75-1495TR) Avail: NTIS CSCL 12/1

In this paper, we show that there exists a sequence of rational functions of the form Rn(z) - Pn-1(z)/(1+z/n)n, n-1,2,..., with deg PN-1-<n-1, which converges geometrically to e(-z) in the uniform norm on [0,inifinity), as well as on some infinite sector symmetric about the positive real axis. We also discuss the usefulness of such rational functions in approximating the solutions of heat-conduction type problems. GRA

N76-19874# University of South Florida, Tampa. Dept. of Mathematics.
ON THE ZEROS AND POLES OF PADE APPROXIMANTS TO THE EXPONENTIAL FUNCTION Interim Report
E. B. Saff and R. S. Varga 1975 30 p refs
(Grants AF-AFOSR-2688-74; AT(11-1)-2075; AF Proj. 9749)
(AD-A017587; AFOSR-75-1494TR) Avail: NTIS CSCL 12/1

In this paper, the authors study the location of the zeros and poles of general Pade approximants to (e sup z). The location of these zeros and poles is useful in the analysis of stability for related numerical methods for solving systems of ordinary differential equations. GRA

N76-19875# California Univ., Berkeley. Electronics Research Lab.
THE LIMITATIONS OF JACOBI METHODS FOR TRIANGULATING SQUARE MATRICES Final Report
Ying Wang 17 Oct. 1975 55 p refs
(Contract N00014-69-A-0200-1017)
(AD-A017506; ERL-M551) Avail: NTIS CSCL 12/1

Jacobi methods for symmetric matrices have prompted the search for generalizations to reduce any complex square matrix to upper triangular form using unitary similarity transformations. All attempts have been unsuccessful. It is not the case that all previous investigators have failed to find the right algorithm. It is shown here that there are intrinsic limitations on Jacobi-type procedures. Author (GRA)

N76-19876# California Univ., Berkeley. Operations Research Center.
CREDIBILITY REGRESSION WITH SIMPLE TRENDS
William S. Jewell Sep. 1975 15 p refs
(Grant DAHC04-75-G-0163)
(AD-A017239; ORC-75-16) Avail: NTIS CSCL 12/1

Bayesian linear regression models, where the parameters follow simple trends, can be efficiently solved using credibility approximations and recursive calculations which exploit the special structure of the problem. GRA

N76-19877# Kent State Univ., Ohio. Dept. of Mathematics.
ON DIAGONAL DOMINANCE ARGUMENTS FOR BOUNDING THE NORM OF THE INVERSE MATRIX (A) SUB INFINITY
Richard S. Varga 1975 10 p refs
(Contract E(11-1)-2075; Grant AF-AFOSR-2729-74; AF Proj. 9749)
(AD-A017384; AFOSR-75-1545TR) Avail: NTIS CSCL 12/1

In a recent paper by J. M. Varah, an upper bound for the norm of the inverse matrix (A) sub infinity was determined, under the assumption that A is strictly diagonally dominant, and this bound was then used to obtain a lower bound for the smallest singular value for A. In this note, this upper bound for the norm of the inverse matrix (A) sub infinity is sharpened, and extended to a wider class of matrices. This bound is then used to obtain an improved lower bound for the smallest singular value of a matrix. GRA

N76-19878# Stanford Univ., Calif. Dept. of Computer Science.
ON SPARSE GRAPHS WITH DENSE LONG PATHS
P. Erdos, R. L. Graham, and E. Szemeredi Sep. 1975 17 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-02752-A02; NR Proj. 044-402)
(AD-A017370; SU-STAN-CS-75-504) Avail: NTIS CSCL 12/1

The following problem was raised by H.-J. Stoss in connection with certain questions related to the complexity of Boolean functions. An acyclic directed graph G is said to have property p (m,n) if for any set of X of m vertices of G, there is a directed path of length n in G which does not intersect X. Let f(m,n) denote the minimum number of edges a graph with property p(m,n) can have. GRA

N76-19114* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXTENDING THE LORENTZ TRANSFORMATION BY CHARACTERISTIC COORDINATES
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 927-931 refs (For availability see N76-19059 10-02)
CSCL 12A

N76-19116* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFORMAL COORDINATES ASSOCIATED WITH UNIFORMLY ACCELERATED MOTION
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 939-941 refs (For availability see N76-19059 10-02)
CSCL 12A

N76-19117* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFORMAL COORDINATES ASSOCIATED WITH SPACELIKE MOTIONS
Robert T. Jones *In its* Collected Works of Robert J. Jones Feb. 1976 p 943-956 refs (For availability see N76-19059 10-02)
CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-19879# Institut Franco-Allemand de Recherches, St. Louis (France).
WEAPON EVALUATION USING STOCHASTIC DUEL THEORY [WAFFENBEWERTUNG MIT HILFE DER THEORIE DER STOCHASTISCHEN DUELLE]
V. Fleck 29 Nov. 1974 12 p refs In GERMAN; ENGLISH summary Presented at the Carl-Cranz-Ges. Meeting on Bewertung von Waffensystemen, Porz, West Germany, 18-19 Nov. 1974 (ISL-CO-33/74) Avail: NTIS HC $3.50

The theory of stochastic duels allows an easy determination of the effectiveness of a weapon system under combat conditions. The measure used for the evaluation is the kill probability of an enemy target in a duel combat. Some extensions to the fundamental model proposed by T. Williams and C.J. Ancker have been made for an easier adaptation to combat conditions. A first application of the method was the estimation of the effectiveness of anti-tank weapon systems. Apart from obtaining results of general interest, such as the evaluation of the increase in performance by shortening the time needed for a shot or such as the influence of the combat-time-limitation on effectiveness, a comparison between tube and guided missiles weapons was made. Author (ESA)

N76-19880# Royal Netherlands Meteorological Inst., De Bilt.
A GENERAL LINEAR STATISTICAL MODEL FOR DETERMINING RELATIONS BETWEEN A NUMBER OF VARIABLES [EEN ALGEMEEN LINEAIR STATISTISCH MODEL VOOR BEPALING VAN RELATIES TUSSEN EEN AANTAL GROOTHEDEN]
P. J. Rijkoort 1975 65 p refs In DUTCH; ENGLISH

summary
(KNMI-WR-75-1) Avail: NTIS HC $4.50

An introduction to multivariate statistical analysis is given. The general theory according to Scheffe and Dempster is treated briefly, and some numerical examples are given. A treatment of a special regression problem is presented: the solution of the problem of finding an optimum choice of only r from k variables x(j) to explain the variation y, using a computer. ESA

N76-19881# Naval Surface Weapons Center, Dahlgren, Va.
DETERMINATION OF MISS DISTANCES AND HIT PROBABILITIES IN THE PRESENCE OF TIME VARYING RANDOM, AND BIAS ERRORS Final Report
Michael S. Borowsky Jul. 1975 36 p refs
(AD-A016587; NSWC/DL-TR-3327) Avail: NTIS CSCL 19/4

A Monte-Carlo method for obtaining miss distances due to time varying, random, and bias errors which involves only one random sample per coordinate and closed form approximations for computing the probability of at least one hit and the expected number of hits in an n round engagement are presented. GRA

N76-19882# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
A GENERALIZED STOCHASTIC LANCHESTER ATTRITION PROCESS
Alan F. Karr Sep. 1975 28 p refs
(AD-A015655; P-1080; IDA/HQ-74-16780) Avail: NTIS CSCL 12/1

A mixed-mode, heterogeneous, stochastic Lanchester attrition process is described, which is based on a four-category classification of weapons. Comments are made concerning the distinction between square-law and linear-law combat. Potential applicability of the model in combat simulations is also discussed. Author (GRA)

N76-19883# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
COMBAT PROCESSES AND MATHEMATICAL MODELS OF ATTRITION
Alan F. Karr Sep. 1975 20 p refs
(AD-A015657; P-1081; IDA/HQ-74-16781) Avail: NTIS CSCL 12/1

A general, heuristic scheme for classification of combat processes is presented. The context of the classification is that of computer simulation of theater-level, nonnuclear combat. General comments on attrition modeling are made and preferred attrition models are suggested for certain combat situations. Author (GRA)

N76-19884# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
ON SIMULATIONS OF THE STOCHASTIC, HOMOGENEOUS LANCHESTER SQUARE-LAW ATTRITION PROCESS
Alan F. Karr Sep. 1975 35 p refs
(AD-A015658; P-1112; IDA/HQ-75-17242) Avail: NTIS CSCL 12/1

Results of computerized Monte Carlo simulations of a stochastic, homogeneous Lanchester square-law attrition process are described. Topics investigated include expected numbers of survivors at fixed times, iterated calculations of expected numbers of survivors, and probabilities of forcing the opposing side below a prescribed fraction of initial strength before being so reduced, especially in relation to the Lanchester-square force ratio. Author (GRA)

N76-19885# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
ON SIMULATIONS OF THE STOCHASTIC, HOMOGENEOUS, LANCHESTER LINEAR-LAW ATTRITION PROCESS
Alan F. Karr Sep. 1975 36 p refs
(AD-A015656; P-1113; IDA/HQ-75-17243) Avail: NTIS CSCL 12/1

Results of computerized Monte Carlo simulations of a stochastic, homogeneous Lanchester-linear attrition process are presented. Properties investigated include expected numbers of survivors as functions of time, iterated calculations of expected numbers of survivors, probabilities of forcing the opposing side below a certain fraction of initial strength before being so reduced, and relations of the stochastic model to the deterministic Lanchester-linear model. Author (GRA)

N76-19886# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
ESTIMATION FOR CERTAIN NONLINEAR STOCHASTIC SYSTEMS Interim Report
Steven I. Marcus and Alan S. Willsky 1975 10 p refs
(Grant AF-AFOSR-2273-72; AF Proj. 9769)
(AD-A017618; AFOSR-75-1496TR) Avail: NTIS CSCL 12/1

Recently a great deal of attention has gone into the study of classes of deterministic nonlinear systems described either by bilinear differential state equations or Volterra series input-output relations. In addition, a number of results have been obtained for the stochastic analogs of these systems. In this note the authors describe a class of systems for which they can construct optimal finite-dimensional nonlinear filters. A complete study of this problem is given in another paper. GRA

N76-19887# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
AN OPTIMAL STOPPING PROBLEM FOR SUMS OF DICHOTOMOUS RANDOM VARIABLES
Herman Chernoff and Albert John Petkau 30 Oct. 1975 34 p refs
(Contract N00014-75-C-0555; NR Proj. 042-267)
(AD-A017013; TR-2) Avail: NTIS CSCL 12/1

A stopping problem for sums of dichotomous random variables is defined. The optimal procedure is determined and the limiting behavior of this procedure is examined. This limiting behavior can be used to relate the solution of a class of continuous time stopping problems involving a Wiener process to the solution of certain discrete time, discrete process, stopping problems. These relations are useful in calculating numerical approximations to the solutions of various stopping problems. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-19888* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRAFFIC SURVEY SYSTEM Patent
Joseph H. Kerr, inventor (to NASA) Issued 6 Jan. 1976 6 p Filed 11 Dec. 1974 Supersedes N75-13226 (13 - 04, p 0418)
(NASA-Case-MFS-22631-1; US-Patent-3,930,735; US-Patent-Appl-SN-531572; US-Patent-Class-356-167; US-Patent-Class-340-38P; US-Patent-Class-356-71; US-Patent-Class-356-162) Avail: US Patent Office CSCL 12B

A traffic survey system is described in which an aerial photo survey transparency is first made of a significant survey area, for example, two kilometers square. The transparency is then optically scanned to check the position and size of vehicles on roadways in the area. By computer control comparison with a reference transparency wherein areas other than roadways are made opaque and roadways are made clear, scanning may be directed solely to roadway regions. Vehicle size analysis is accomplished by means of discrete holographic filters corresponding to selected size vehicles. Official Gazette of the U.S. Patent Office

N76-19889# Montpellier Univ. (France). Dept. de Physique Mathematique.
AN APPROACH TO INVERSE PROBLEMS [APPROCHE DES PROBLEMES INVERSES]
P. C. Sabatier [1975] 24 p refs In FRENCH Presented at the Colloq. d'Analyse Numerique, 26 May 1975
(PM/75/13) Avail: NTIS HC $3.50

Problems associated with the mathematical study of inverse problems in physical sciences are considered with regard to inverse scattering and inverse spectral problems. The general definition of an inverse problem is given and the criteria to be satisfied by a valid solution are reviewed. The distinction between the

mathematician and the physicist's point of view is emphasized. ESA

N76-19890# California Univ., Los Angeles. Dept. of Computer Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 1 Jul. - 31 Dec. 1974
Leonard Kleinrock 31 Dec. 1974 290 p refs
(Contract DAHC15-73-C-0368)
(AD-A016823) Avail: NTIS CSCL 09/2

A major area of research during this period has been that of packet switching in radio channels. The problem here is to make a contribution to the design of terminal access networks, namely those which lie between the terminal itself and perhaps a high level network such as the ARPANET. The communication medium studied is that of radio transmission in a digital mode and takes advantage of the resource sharing and packet switching principles which were developed for the study of the ARPANET and for the study of satellite communications in a packet switched mode. The central issues here involve the analysis of the behavior of a collection of terminals communicating with a radio repeater in a highly uncontrolled fashion. The key idea here as opposed to satellite packet switching is that terminals may listen to other terminals: transmissions by sensing the radio frequency carrier and if the channel is sensed busy than other terminals will inhibit their own transmissions thereby preventing a collision. The hidden terminal problem is studied as well as a busy tone solution to that problem. GRA

N76-19891# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
DEMONSTRATION AND EVALUATION OF A FAULT-TOLERANT INPUT/OUTPUT NETWORK Final Report, Sep. 1974 - Aug. 1975
John F. McKenna, Jr. Sep. 1975 92 p refs
(Contract N00014-75-C-0050)
(AD-A015920; R-918) Avail: NTIS CSCL 09/2

A digital computer input/output data network is evaluated as to its ability to be reconfigured, tested, and managed. The network is topologically more complex than a bus structure, each node being connected to three, rather than two, internodal links. The extra connectivity offers redundancy that can be used to tolerate failures of any kind in links as well as to circumvent paralysis of the system due to an actively malfunctioning node. The software overhead of the network amounts to less than 2K 16-bit words of instructions and data for a moderate size system. The bandwidth overhead is variable depending on the degree of security desired, and can range from several percent to tens of percent. GRA

N76-19892# Network Analysis Corp., Glen Cove, N.Y.
THE PRACTICAL IMPACT OF RECENT COMPUTER ADVANCES ON THE ANALYSIS AND DESIGN OF LARGE SCALE NETWORKS Semiannual Technical Report
Howard Frank and Richard Van Slyke Dec. 1974 135 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A016578; SATR-4B) Avail: NTIS CSCL 09/2

This report summarizes studies of local, regional, and large scale data communication network problems. Primary emphasis is placed on system issues and tradeoffs. Areas discussed are packet radio system studies, packet radio system algorithms and control, local and regional data network cost comparisons and alternatives, and integrated large scale packet switched network cost and performance. Studies of multidropped, point-to-point, and broad band cable and radio broadcast systems as well as the impact of satellites on network cost and performance are described. GRA

N76-19893# Massachusetts Inst. of Tech., Cambridge. Project MAC
SEMANTICS OF COMMUNICATING PARALLEL PROCESSES Ph.D. Thesis
Irene Greif Sep. 1975 165 p refs
(Contract N00014-75-C-0522)
(AD-A016302; MAC-TR-154) Avail: NTIS CSCL 09/2

The theme of this report is that an understanding of the ordering constraints that are introduced among events of parallel processes is essential to the understanding of synchronization and that therefore any language for specifying synchronization of parallel processes should be based on a theory of such orderings. While it is possible to write specifications for systems of communicating parallel processes by reference to the time ordering of some global clock external to the system, such specifications cannot be as useful as one which are in terms of orderings derivable within the system. Specifications should place constraints on intended behavior of the computer system itself rather than on the possible observations of the system's behaviors from some global viewpoint which may in fact be totally unrealizable. The dissertation is a development of a specification language. It is based on a model of computation in which an individual process is represented by a totally ordered set of events. GRA

N76-19894# California Univ., Berkeley. Operations Research Center.
AN EXTENSION OF ERLANG'S LOSS FORMULA
Ronald W. Wolff and Charles W. Wrightson Oct. 1975 14 p refs
(Contract DAHC04-75-G-0163)
(AD-A017637; ORC-75-19) Avail: NTIS CSCL 12/2

A two server loss system is considered with N classes of Poisson arrivals, where the service distribution function and server preferences are arrival class dependent. The stationary state probabilities are derived and found to be independent of the form of the service distributions. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-19895 Stanford Univ., Calif.
SPECTRAL THEORY AND THE EXTERNAL FIELD MODEL FOR THE DIRAC EQUATION Ph.D. Thesis
John Nelson Palmer 1975 163 p
Avail: Univ. Microfilms Order No. 76-5778

A preliminary procedure which presents the Dirac field and Dirac equation in a different fashion than is customary is reported. In particular a natural complex structure on the one particle space simplifies the presentation of the Dirac field. Fock representations of the Clifford Algebra, of a real Hilbert space are studied. The Fock representations are parametrized by complex structures on the real Hilbert space and the Fock representations associated with two complex structures Lambda 1 and Lambda 4 are shown to be unitarily equivalent if and only if the difference Lambda 1 - Lambda 2 is Hilbert-Schmidt. Section two deals with questions of spectral theory for perturbations of the Dirac operator. The principal results show the absense of singular continuous spectrum for the general class of short range relatively compact multiplicative perturbations, and continuum embedded eigenvalues for a somewhat less general class of perturbations. Dissert. Abstr.

N76-19896# Stanford Univ., Calif. Dept. of Computer Science.
ANALYSIS OF THE SUBTRACTIVE ALGORITHM FOR GREATEST COMMON DIVISORS
Andrew C. Yao and Donald E. Knuth Sep. 1975 15 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DRC-72-03752-A02; NR Proj. 044-402)
(AD-A017054; SU-STAN-CS-75-510) Avail: NTIS CSCL 12/1

The sum of all partial quotients in the regular continued fraction expansions of m/n, for 1 smaller than or equal to m smaller than or equal to n, is shown to be 6 pi/2 n(1n n) squared + O(n log n (log log n)squared. This result is applied to the analysis of what is perhaps the oldest nontrivial algorithm for number-theoretic computations. Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-19897# Montpellier Univ. (France). Dept. de Physique Mathematique.
INVERSE SCATTERING PROBLEMS IN ABSORBING MEDIA
M. Jaulent Sep. 1975 25 p refs
(PM/75/14) Avail: NTIS HC $3.50

Inverse scattering problems were studied which occur in various fields of physics (transmission lines theory, electromagnetism, elasticity theory), and in which the inhomogeneous media considered are absorbing. It was supposed that waves propagate in a z-direction from z = o to z = infinity and are totally reflected at z = o, the input data being the values of the reflection coefficient to the right S(+)(k) for all frequencies k (note that the case where waves propagate from z = -infinity to z = infinity can be studied in a similar way). These problems are reduced to an inverse scattering problem for the radial s-wave Schroedinger equation with an energy-dependent potential. The case where S(+)(k) is close to one and the case where the absorption is weak were specially investigated. A class of exactly solvable examples is given. Author (ESA)

N76-19115* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF ACCELERATED MOTION IN THE THEORY OF RELATIVITY
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 933-937 refs (For availability see N76-19059 10-02)
CSCL 20J

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-19898*# Kanner (Leo) Associates, Redwood City, Calif.
ABSORPTION OF AUDIBLE SOUNDS IN THE AIR AND ITS DEPENDENCE ON MOISTURE AND TEMPERATURE
H. Knotzel Washington NASA Mar. 1976 30 p refs Transl. into ENGLISH from Akust. Z. (Leipzig), v. 5, no. 5, Sep. 1940 p 245-256
(Contract NASw-2791)
(NASA-TT-F-16918) Avail: NTIS HC $4.00 CSCL 20A

The tests in air covered the entire frequency range from 0.6 to 5kc/s, and moisture content ranging from 0 to 70% relative humidity, at room temperature and at 0 C. It is shown that the frequency of maxmum absorption increases quadratically with the moisture content, due to molecular absorption. Reference tests with nitrogen were also conducted. Author

N76-19899*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ACOUSTO-AERODYNAMIC STUDIES
A. V. Rimskiy-Korsakov, ed. Washington NASA Mar. 1976 134 p refs Transl. into ENGLISH of the book "Akustiko-Aerodinamicheskiye Issledovaniya" Moscow, Nauka Press, 1975 p 3-98
(Contract NASw-2789)
(NASA-TT-F-16895) Avail: NTIS HC $6.00 CSCL 20A

Theoretical and experimental studies of questions concerning turbulent noise generation and interactions of turbulent flows with elastic bodies are presented. Topics include the stability of a flow in a tube with impedance walls, soundproofing of shells in random fields, techniques for suppressing discrete noise components in ejectors, the acoustic pressure field of vortex sound near rotating blades, sound emission and propagation in a cylindrical tube in the presence of flow, soundproofing in a cylindrical duct, and the excitation of structural elements by a turbulent gas flow past those elements. Author

N76-19900*# United Technologies Research Center, East Hartford, Conn.
PREDICTION OF ROTATING-BLADE VORTEX NOISE FROM NOISE OF NONROTATING BLADES Final Report
Martin R. Fink, Robert H. Schlinker, and Roy K. Amiet Mar. 1976 120 p refs
(Contract NAS1-13372)
(NASA-CR-2611) Avail: NTIS HC $5.50 CSCL 20A

Measurements were conducted in an acoustic wind tunnel to determine vortex noise of nonrotating circular cylinders and NACA 0012 airfoils. Both constant-width and spanwise tapered models were tested at a low turbulence level. The constant-diameter cylinder and constant-chord airfoil also were tested in the turbulent wake generated by an upstream cylinder or airfoil. Vortex noise radiation from nonrotating circular cylinders at Reynolds numbers matching those of the rotating-blade tests were found to be strongly dependent on surface conditions and Reynolds number. Vortex noise of rotating circular cylinder blades, operating with and without the shed wake blown downstream, could be predicted using data for nonrotating circular cylinders as functions of Reynolds number. Vortex noise of nonrotating airfoils was found to be trailing-edge noise at a time frequence equal to that predicted for maximum-amplitude Tollmein-Schlichting instability waves at the trailing edge. Author

N76-19901# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
ACOUSTIC VELOCITY CORRELATOR Final Report, 1 Sep. 1973 - 31 Aug. 1974
R. C. Knittle and T. W. Bristol Aug. 1975 58 p refs
(Contract DAAB07-72-C-0121; DA Proj. 7X2-63304-D-215)
(AD-A016159; FR-75-14-522; ECOM-72-0121-F) Avail: NTIS CSCL 09/1

The program has demonstrated the feasibility of implementing a 16 input x 16 output channel velocity correlator network of a Pulse Burst Processor System using acoustic surface waves. The acoustic velocity correlator is a network of multiple tapped delay lines which corrects the Doppler time shifts of the output signals from a pulse burst tapped delay line and sums the corrected signals in a single Doppler velocity channel. A 50 MHz bandwidth, 8 x 9 channel prototype device was developed on this program which demonstrates the feasibility of implementing a 16 x 16 channel velocity correlator. One of the most important achievements of this program was the development of a technique to fabricate high frequency surface wave transducers by direct projection of oversized patterns onto a substrate over a 1 in x 1 in area. This report describes the design, fabrication, and testing of the 8 x 9 channel prototype device. GRA

N76-19902# Stanford Research Inst., Menlo Park, Calif.
LOW FREQUENCY SOUND PROPAGATION IN A FLUCTUATING INFINITE OCEAN, 2
F. Zachariasen Jun. 1975 38 p refs
(Contract DAHC15-73-c-0370; ARPA Order 2504; SRI Proj. 3000)
(AD-A016630; SRI-JSR-74-6) Avail: NTIS CSCL 20/1

An approximation method for calculating fluctuations due to internal waves in sound propagation in the ocean is outlined, including the effects of the sound channel. Results are presented in a simple form in which the geometrical optics limit is transparent. Author (GRA)

N76-19903# SACLANT ASW Research Center, La Spezia (Italy).
THE USE OF THE PARABOLIC EQUATION METHOD IN SOUND PROPAGATION MODELLING
Finn Jensen and Hans Krol 15 Aug. 1975 50 p refs Sponsored by NATO
(AD-A016847; SACLANTCEN-SM-72) Avail: NTIS CSCL 20/1

The parabolic equation method (PE method) is the latest major development in the field of acoustic modelling. A detailed description of the derivation of the parabolic equation from the wave equation is given together with a description of a marching solution technique based on Fast Fourier Transforms (FFT). Limitations on the method in terms of allowable step length in range, number of FFT points to be used, and restrictions on pressure field behaviour in order to obtain a stable solution, are mentioned. Furthermore, numerical examples of propagation predictions are given for both shallow and deep water cases, with and without bottom absorption, and for both range-dependent and range-independent environmental conditions. GRA

N76-19904# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mathematical Sciences.
DEEP-OCEAN DYNAMICS FOR ENVIRONMENTAL-ACOUSTICS MODELS
J. G. Watson, W. L. Siegmann, and M. J. Jacobson 15 Nov. 1975 52 p refs
(Contract N00014-67-A-0117-0002; NR Proj. 386-606)
(AD-A016830; RPI-Math-110) Avail: NTIS CSCL 20/1

A hydrodynamic model for flows in the deep ocean is developed in order to determine the velocity field and sound-speed distribution for use in acoustic transmission problems. A scaling of the governing equations is constructed that explicity includes sound speed. A subsequent pertubation expansion yields a set of approximate equations for motions nearly in geostrophic and hydrostatic balance, such as large-scale, quasi-steady currents and Rossby waves. The stream function for these flows is shown to satisfy either the quasi-geostrophic potential vorticity equation or a simpler limiting case of this equation. The results of the analysis are used to obtain a significant simplification of the ray equations of geometrical acoustics for moving media. For the particular class of flows considered here, the model equations are applicable if the ocean depth is about 1 km or greater and if the spatial and temporal scales of variation of the motions are of the order of 100 km and 10 days, respectively. A solution for a flow such as the Antilles current is derived. Isospeed curves for this solution are shown in a plane perpendicular to the current, and specific features of the curves are discussed and interpreted. GRA

N76-19905# Maryland Univ., College Park. Dept. of Mechanical Engineering.
THE VIBRATIONS OF AN INFINITE ORTHOTROPIC LAYERED VISCOELASTIC SHELL IN AN ACOUSTIC MEDIUM
Bruce S. Berger Sep. 1975 18 p refs
(Contract N00014-67-A-0239-0020)
(AD-A016628) Avail: NTIS CSCL 20/1

The solution of the vibration of an orthotropic layered cylindrical viscoelastic shell in an acoustic medium is derived through the application of the theorem of correspondence to the shell equations of motion. The acoustic fluid is modelled through a finite difference scheme. Numerical results for the normal displacements are in exact agreement with known elastic solutions. Author (GRA)

N76-19906# Middleton (David), Cambridge, Mass.
A NEW APPROACH TO SCATTERING PROBLEMS IN RANDOM MEDIA
David Middleton Jun. 1975 42 p refs Presented at 4th Intern. Symp. on Multivariate Analysis, Dayton, Ohio, 16-20 Jun. 1975 Submitted for publication
(Contract N00014-70-C-0198)
(AD-A016659) Avail: NTIS CSCL 20/1

A new approach to scattering of radiation from random media and interfaces is outlined. Topics discussed include the following: Model of a differential scattering element; Statistical properties of the dN(Z)M moments; Langevin equations and the scattered field; an example. Acoustic scattering from the random moving ocean surface. GRA

N76-19907# California Univ., Los Angeles. School of Engineering and Applied Science.
AMPLITUDE DISTRIBUTION ANALYSIS OF ACOUSTIC EMISSION SIGNALS
Kanji Ono Aug. 1975 26 p refs
(Contract N00014-75-C-0419)
(AD-A017004; UCLA-ENG-7569) Avail: NTIS CSCL 20/1

Acoustic emission signal characterization via amplitude distribution analysis is discussed from theoretical and experimental viewpoints. Fundamental amplitude distribution characteristics of continuous- and burst-type acoustic emission signals are derived and compared with experiment. Regardless of the signal bandwidth, continuous-type signals exhibit the Rayleigh-type peak distribution. Relationship between the amplitude distribution of acoustic emission counts and the peak distribution of burst signals is discussed, considering three model peak distribution functions. Proposed in this paper are new calibration method of acoustic emission instrumentation and a means to separate the contributions of continuous- and burst-type acoustic emission signals. GRA

N76-19908# Naval Postgraduate School, Monterey, Calif.
THE SPATIAL AND TEMPORAL VARIATION OF SOUND SPEED IN THE CALIFORNIA CURRENT SYSTEM OFF MONTEREY, CALIFORNIA M.S. Thesis
John George Hughes Dec. 1975 108 p refs
(AD-A017573) Avail: NTIS CSCL 20/1

The horizontal sound speed in an area of complex oceanographic structure was described using cross sections obtained from six nonconsecutive monthly lines of STD observations at a 5.5 km sampling interval off Monterey, California. The sound speed field for each section was determined and visually analyzed. Cross-correlation functions of vertical sound speed gradients averaged over 2 m and 10 m increments were computed between stations. Cross-correlation coefficients between stations were computed for detrended sound speed profiles sampled at 2 m depth increments. Sound speed was an excellent descriptor of water mass features. On depth scales greater than 10 m, well defined sound speed field features showed horizontal extents of less than 11 km in some cases. On vertical scales of 2 to 10 m horizontal extents of less than 11 km were also evident. Sound speed profiles showing similarities on the scale of 2 to 10 m tended to occur at 27.5 to 38.5 km intervals. GRA

N76-19909# Little (Arthur D.), Inc., Cambridge, Mass.
NEW RAY METHODS IN PROPAGATION
Bernard O. Koopman 1 Nov. 1975 362 p refs
(Contract N00014-72-C-0173)
(AD-A017007) Avail: NTIS CSCL 20/1

The object of this report is to supply the theoretical bases for certain useful and computable approximations to the problem of transmission loss in hydroacoustic propagation. These approximations involve a knowledge of two acoustic profiles, one at the emitter and the other at the receiver and only require general assumptions of the intermediate behavior of sound speed. In this sense they form a 'second approximation'--the 'first approximation' being the familiar one based on the assumption of an acoustic profile independent of range. The ranges are long enough to involve multiple-path transmission, caustics, and the complications produced by many convergence zones. The random factors and incomplete knowledge of the medium of transmission are not only explicitly acknowledged but are made to play a central role in the discussion: they give rise to a somewhat novel model and open up possibilities of simplification of averages, etc. GRA

N76-19910# Little (Arthur D.), Inc., Cambridge, Mass.
COMPUTATION OF LONG-RANGE PROPAGATION LOSSES IN A DUCT
Gordon Raisbeck 1 Nov. 1975 347 p refs
(Contract N00014-72-C-0173)
(AD-A017006) Avail: NTIS CSCL 20/1

An acoustic ray shows the direction in which acoustic energy flows, but not the intensity of the resulting field. The conventional way to estimate intensity is to infer the cross-section of a narrow bundle of rays from the difference in the trajectories of a closely spaced pair of rays. Where the distance is long, the detailed sound velocity structure is uncertain, and multi-path propagation exists, there are both practical and theoretical objections to this procedure. As an alternative, one can seek the average intensity at a given depth over a range interval about a nominal range. The resulting expression involves no differencing of ray trajectory parameters, only summing, which is computationally preferable. To a first approximation, the resulting expression depends only on the velocity profiles at the source and receiver and the distance between them, but not on the detailed velocity structure between. This conceptually simple space average can be shown to be equivalent to the average of expected value resulting, by much more profound arguments, from uncertainty or from spatial or temporal fluctuations in the sound velocity structure. GRA

N76-19911# Maryland Univ., College Park. Glenn L. Martin Inst. of Technology.
REFLECTED AND RADIATED ACOUSTIC PRESSURE FROM AN ELASTIC SHELL OF REVOLUTION Interim Report

Bruce S. Berger Oct. 1975 21 p refs
(Contract N00014-67-A-0239-0020)
(AD-A017282; Rept-3-75) Avail: NTIS CSCL 20/1

A solution for transient vibration of an elastic shell of revolution surrounded by an acoustic medium is given. The acoustic fluid is modelled through a finite difference scheme based on a mapping from the spheroidal coordinate system. The solution for the shell of revolution is based on a finite difference scheme. The solution is exact to within the order of the finite difference approximations. GRA

N76-19122* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMPLE VIOLIN OSCILLATOR
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 1019-1024 (For availability see N76-19059 10-02) CSCL 20A

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-19912 Florida State Univ., Tallahassee.
RELATIVISTIC EFFECTS IN INELASTIC ELECTRON-MERCURY SCATTERING AT 25 eV TO 180 eV Ph.D. Thesis
Ralph Vernon Calhoun, Jr. 1975 96 p
Avail: Univ. Microfilms Order No. 76-2627

A relativistic distorted-wave approximation is developed for handling inelastic electron-heavy atom collisions. The relativistic distorted-wave approximation is developed in a jj-coupling scheme with the distorted-waves given by solutions of the Dirac equation for a central field. The theory is applied to the 1 s sub 0 to 1 p sub 1 transition in mercury, for the energy range 25 eV to 180 eV, to ascertain the importance of relativistic effects at low energies. Results of this calculation are compared to a distorted-wave calculation using relativistic potentials and non-relativistic wave functions. The relativistic distorted-wave calculation was found to be extremely sensitive to the bound-state wave functions. Relativistic calculations of bound-state wave functions lead to charge densities which are contracted with respect to the nonrelativistic charge density. The difference in the relativistic distorted-wave calculation and the non-relativistic distorted-wave calculation arise mainly from this contraction of the relativistic orbitals. Dissert. Abstr.

N76-19913 City Univ. of New York.
OPTIMIZED EXCITED STATE OF ATOMS, INTERMEDIATE: ENERGY SCATTERING Ph.D. Thesis
Arthur Benjamin Weglein 1975 128 p
Avail: Univ. Microfilms Order No. 76-5513

The optimization of the average excited state of an atom (via a Kohn variational principle) was investigated. The resulting non-linear coupled integro-differential equations for the optimized excited state and the elastic and inelastic scattering coefficients were studied with two purposes in mind: (1) to extract electron-atom scattering information from this optimized two state model and (2) to attempt to assign some physical reality to the optimized excited state of an atom. Dissert. Abstr.

N76-19914 Detroit Univ., Mich.
A ONE CENTER STUDY OF THE HELIUM ATOM HYDROGEN MOLECULAR INTERACTION Ph.D. Thesis
Min-Hsiung Lien 1972 163 p
Avail: Univ. Microfilms Order No. 76-6043

One-center expansion wave functions were calculated for the helium-atom-hydrogen-molecule system at three internuclear distances. Letting R sub He-H represent the distance measured from the helium nucleus to the proton in the middle in the linear helium-atom-hydrogen-molecule system, results are reported for R sub He-H equals 0.6, 1.0, and 1.4 A. An orbital basis set consisting of nine Slater-type orbitals is also discussed. The method of configuration interaction was used to develop a thirty-two-term wave function. Also a six-term one-center wave function was determined for the off-center helium atom, using Slater orbitals of noninteger principal quantum number. Dissert. Abstr.

N76-19915# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DUMDUM: A COMPUTER CODE TO GENERATE AN INITIAL DENSITY MATRIX FOR AB INITIO MO-LCAO-SCF CALCULATIONS Final Memorandum Report
George F. Adams Aug. 1975 41 p refs
(DA Proj. 1T1-61102-A-14B)
(AD-A016114; BRL-MR-2514) Avail: NTIS CSCL 07/4

This report describes the development of and provides documentation for the use of a computer code named DUMDUM. The code generates an initial guess at a one-electron density matrix for use as input to an ab initio MO-LCAO-SCF calculation. The rationale for writing the code is discussed, and examples of its use are presented. GRA

N76-19916# Aerospace Corp., El Segundo, Calif. Lab Operations.
VIBRATIONAL RELAXATION OF DF BY He AND Ar
Jerry F. Bott 30 Aug. 1975 10 p refs
(Contract F04701-75-C-0076)
(AD-A016062; TR-0076(6603)-5; SAMSO-TR-75-228) Avail: NTIS CSCL 07/4

The vibrational relaxation of DF by He has been measured in shock-tube experiments. The vibrational relaxation times of DF in Ar were measured near 1,000 K and are in good agreement with extrapolations of previous studies at higher temperatures. GRA

N76-19917# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
NUCLEATION EXPERIMENTS IN MOLECULAR BEAMS
James A. Armstrong Sep. 1975 11 p refs
(Contract N00014-67-A-0356-0027; NR Proj. 092-544)
(AD-A015705) Avail: NTIS CSCL 07/4

A nozzle molecular beam is used as a cluster generator, and the beam is examined with an ionization gage detector and high energy electron diffraction. The diffraction patterns of carbon dioxide and water for conditions of maximum clustering have 'averaged' cluster sizes of 1,400 and 3,400 molecules/cluster, and crystalline structure of simple cubic and diamond cubic which is characteristic of their respective bulk phases. GRA

N76-19918# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
ELECTRON DIFFRACTION STUDIES OF CLUSTERED NOZZLE BEAMS
Philip R. Jeuck, Gerald Saxon, and Gilbert D. Stein Sep. 1975 13 p refs
(Contract N00014-67-A-0356-0027; NR Proj. 092-544)
(AD-A015706) Avail: NTIS CSCL 07/4

The goal of the work outlined here is to determine the structure of atomic and molecular clusters small engough to constitute the starting or critical size for phase transitions from the vapor state (i.e. 10-100 molecules/cluster). The clusters are nucleated homogeneously from the vapor phase in the free jet expansion of a molecular beam apparatus. Their size and structure are obtained through use of high energy electron diffraction. Additional stages of differential pumping have been added in order to get the molecular beam-electron scattering chamber down to the 10 to the -8 power to 10 to the -9 power toor range. Diffraction patterns will be taken by sweeping them over a slit-phosphor scintillator-photomultiplier arrangement using magnetic coils. Conservative estimates on the minimum cluster sizes attainable using the lower pressure scattering chamber and phase sensitive detection are presented. GRA

N76-19919# National Bureau of Standards, Washington, D.C.
POTENTIAL ENERGY SURFACES FOR AIR TRIATOMICS. VOLUME 2: RESULTS OF SCF AND PRELIMINARY OVC CALCULATIONS Interim Report, Jul. - Dec. 1974
P. J. Fortune, D. G. Hopper, B. J. Rosenberg, W. B. England, and G. Das Jun. 1975 119 p refs
(Contract F33615-72-M-5016)

(AD-A015856; ARL-75-0202-Vol-2) Avail: NTIS CSCL 07/4

Computations at the SCF and MCSCF levels have been made on the vertical excitation energies and some of the ground and excited state potential surfaces of the fifteen air triatomic molecules: water, nitrogen dioxide, ozone, carbon dioxide, nitrous oxide, and their positive and negative ions. The results presented are preliminary for the most part. Their accuracy will be assessed in a later report in which correlation effects will be more extensively examined than that have been in the present report. GRA

N76-19920# GTE Labs., Inc., Waltham, Mass.
HIGH FIELD CONDUCTION AND BREAKDOWN IN APROTIC LIQUIDS
J. M. Proud and J. J. Amborn Sep. 1975 17 p refs
(Contract N00014-74-C-0215; NR Proj. 359-570)
(AD-A017284; TR-2) Avail: NTIS CSCL 07/4

Energetic electron processes may exist in aprotic liquids due to the absence of C-H molecular bonds. Two liquids, molten sulfur and S2Cl2, have been investigated. Evidence for high field tunneling and a liquid phase Townsend alpha-process is found in liquid sulfur. Nanosecond pulse breakdown data provides additional evidence for liquid phase electron avalanche behavior in S2Cl2. The nanosecond breakdown statistics are compared for hydrocarbon as well as aprotic liquids. GRA

N76-19921# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
RADIAL DIFFUSION ON INNER-ZONE PROTONS: OBSERVATIONS AND VARIATIONAL ANALYSIS Interim Report
Donald R. Croley, Jr., Michael Schulz, and J. Bernard Blake 15 Oct. 1975 52 p refs
(Contract F04701-75-C-0076)
(AD-A017200; TR-0076(6260-20)-1; SAMSO-TR-75-240) Avail: NTIS CSCL 20/8

Omnidirectional proton intensities are measured in seven channels by means of instruments on board the satellite OV1-19. Unidirectional spectra representative of the time interval March-November 1969 (a period near solar maximum) are constructed from the data by standard methods. The results enable one to construct the distribution function f(M,L) at vanishing second invariant J for 1.18 less than or equal to L less than or equal to 2. The profiles of f(M,L) thus obtained are manipulated by a new variational method to yield normalization parameters for radial-diffusion coefficients, caused by magnetic and electrostatic impulses of magnetospheric extent. Author

N76-19922# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
PULSE NMR STUDIES OF MOLECULAR STRUCTURE AND DYNAMICS Final Report, 15 Jan. 1973 - 31 Aug. 1975
Charles N. Reilley, B. W. Good, and J. P. Koontz 15 Sep. 1975 12 p refs
(Grant DA-ARO(D)-31-124-73-G107)
(AD-A017178; ARO-11475.3-EL) Avail: NTIS CSCL 20/8

Transmitter/probe impedance matching networks (1H, 19F, 31P, 23Na, 13C, 14N) and preamplifiers (1H, 13C) have been developed for a Varian probe and magnet. A real-time analog interface and computer/computer communications were implemented for this NMR system. Also a micro-computer prototype capable of spectrometer control and data acquisition is operational. Display peripherals and magnetic field control hardware were also developed. Software for data acquisition, reduction and presentation (including Fourier routines) is functional. The lanthanide-induced isotropic shifts in 13C and 1H NMR spectra of axially symmetric tris complexes of dipicolinic acid and its para-methyl analog are analyzed using (1) geometric factors calculated from crystallographic data and (2) Golding's theory of contact shifts and either Bleaney's theory of dipolar shifts or experimental 'contact free' shifts. Resulting geometric factors are applied to quantitative structure analysis. A systematic study of the 'protonation shifts' in 13C spectra of aliphatic amines, amino-alcohols and ethers and polyamines has been performed. By regression analysis a means for the prediction of protonation shifts has been developed to aid spectral assignments and monitor the microscopic protonation behavior of polybasic molecules. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-19923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFERENTIAL CROSS-SECTION FOR POSITRONIUM FORMATION IN ELECTRON-ATOMIC HYDROGEN COLLISIONS
R. J. Drachman, K. Omidvar, and J. H. McGuire (Kansas State Univ.) Mar. 1976 15 p refs Submitted for publication
(NASA-TM-X-71082; X-602-76-58) Avail: NTIS HC $3.50 CSCL 20H

The L=0 and 1 partial wave amplitudes obtained by a two-state coupled static approximation with correlation with the L greater than or equal to 2 Born amplitudes were combined to obtain the differential cross section for positronium formation in electron-atomic hydrogen collisions. For positron energies of 0.64 and 0.75 ryd, minima at the scattering angles of 57 deg and 51 deg are found. Total cross sections for positronium formation for low and intermediate impact energies are given. Measurement of the differential cross section for the process positron + helium yields positronium + helium ion for the detection of possible minima is suggested. Author

N76-19924*# United Technologies Research Center, East Hartford, Conn.
VACUUM ULTRAVIOLET SPECTRA OF URANIUM HEXAFLUORIDE/ARGON MIXTURES
N. L. Krascella Washington NASA Mar. 1976 40 p refs
(Contract NAS1-13291)
(NASA-CR-2666) Avail: NTIS HC $4.00 CSCL 18K

The transmission properties of room temperature helium at pressures up to 20 atmospheres were determined in the wavelength range from 80 to 300 nm. Similarly, the transmission properties of uranium hexafluoride at 393 K (pressures less than 1.0 mm) were determined in the wavelength range from 80 to about 120 nm. The results show that high pressure helium is sufficiently transparent in the vacuum ultraviolet region (provided trace contaminants are removed) to be utilized as a transparent purge gas in future fissioning gaseous uranium plasma reactor experiments. Absorption cross sections for uranium hexafluoride were calculated from the data between 80 and 120 nm and were of the order of 10 to the -17 power sq cm. Author

N76-19925# Energy Research and Development Administration, Washington, D.C. Div. of Reactor Research and Development.
ADVANCED NUCLEAR REACTORS: AN INTRODUCTION
Aug. 1975 79 p
(ERDA-46) Avail: NTIS HC $4.00

An elementary discussion of uranium fueled reactors is presented, and the role of the Liquid metal fast breeder reactor in the efficient use of fission fuel resources is discussed. NSA

N76-19926# Sandia Labs., Albuquerque, N.Mex.
PULSED NEUTRON STUDIES FOR FUSION REACTOR MATERIALS STUDIES
A. J. Teopfer, T. H. Martin, M. J. Clauser, D. W. Swain, and E. H. Beckner 1975 18 p refs Presented at Intern. Conf. on Radiation Test Facilities for the CTR Surface and Mater. Program, Argonne, Ill., 15 Jul. 1975 Sponsored by ERDA
(SAND-75-5442; Conf-750723-2) Avail: NTIS HC $4.00

Pulsed neutron sources for fusion reactor materials studies which use intense D2 ion beams to irradiated tritiated targets, and intense relativistic electron beams to implode DT filled targets to thermonuclear burn are described. In present accelerators, high current ion beams are produced by space-charge limited emission from the anode plasma in vacuum diodes. Using deuterated electrodes, greater than 10 to the 9th power, neutrons (2.5 MeV) were produced from the D(d,n)He3 reaction, without optimization of the diodes for ion beam production on a 400 kV, 8 kJ accelerator. The use of diodes designed to enhance the fraction of energy carried by the ion beam, and utilizing microsecond-pulse diodes, could lead to at least an order of

magnitude enhancement in the neutron yield. With no enhancement, scaling of present results to a 10 to the 13th power W accelerator operating at 1.5 MV with tritiated electrodes, results in estimated neutron yields greater than 10 to the 12th power n/pulse in the 1976 to 1977 time frame. Author (NSA)

N76-19927# Brookhaven National Lab., Upton, N.Y.
HEAVY ION SPACE CHARGE LIMITS
A. W. Maschke 21 Jul. 1975 4 p refs Sponsored by ERDA
(BNL-20297) Avail: NTIS HC $4.00

Modern ultra-high vacuum technology makes it possible to accelerate and store heavy ions in low charge states. Such quasi-neutralized beams give rise to very high space charge limits in conventional charged particle storage rings and transport systems. In addition, the z squared dependence of dE/dx gives rise to very short ranges for very high energies. Space charge limits are evaluated for a linear transport system, and it is shown that realistically achievable powers and energies are of interest for the ignition of thermonuclear pellets. Author (NSA)

N76-19928# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
HEATING RATE CALCULATIONS
M. A. Capo and D. W. Call [1975] 12 p refs Sponsored by ERDA
(WANL-TME-003) Avail: NTIS HC $4.00

Heating rate calculations are presented for several traverses in the KIWI B-1 reactor core, pressure vessel, support plate, and reflector. Calculations were also made along the centerline of a typical lithium hydride-stainless steel shield. The configuration used in these calculations consisted of the reactor core, the graphite and beryllium relfector, the aluminum top support plate, a cylindrical aluminum pressure vessel, and a typical lithium hydride-stainless steel shield. Author (NSA)

N76-19929# Battelle Pacific Northwest Labs., Richland, Wash.
SHIELDING CALCULATIONAL SYSTEM FOR PLUTONIUM
M. G. Zimmerman and D. H. Thomsen Aug. 1975 87 p refs (Contract E(45-1)-1830)
(BNWL-1855) Avail: NTIS HC $5.45

A computer calculational system was developed and assembled specifically for calculating dose rates in AEC plutonium fabrication facilities. The system consists of two computer codes and all nuclear data necessary for calculation of neutron and gamma dose rates from plutonium. The codes include the multigroup version of the Battelle Monte Carlo code for solution of general neutron and gamma shielding problems and the PUSHLD code for solution of shielding problems where low energy gamma and X-rays are important. The nuclear data consists of built in neutron and gamma yields and spectra for various plutonium compounds, an automatic calculation of age effects and all cross sections commonly used. Experimental correlations were performed to verify portions of the calculational system. NSA

N76-19930# Montpellier Univ. (France). Dept. de Physique Mathematique.
GENERATING FUNCTIONS AND FUNCTIONALS FOR ELEMENTARY PARTICLES MULTIPLE PRODUCTION [FONCTIONS ET FONCTIONNELLES GENERATRICES. PRODUCTION MULTIPLE DE PARTICULES ELEMENTAIRES]
Yves Loubatieres Mar. 1975 79 p refs In FRENCH
(PM/75/7) Avail: NTIS HC $5.00

The formalism of functions and functionals acting as generators of multiple elementary particles production is detailed. A general review of the main properties that follow from the formalism is made. The sum rules and additive properties subject to conservation are demonstrated. The construction of a charge conserving generator function is formulated starting from the set of inclusive correlations pertaining to charged and neutral particles. ESA

N76-19931# Montpellier Univ. (France). Dept. de Physique Mathematique.
THE REACTION e(PLUS)e(MINUS) YIELDS 3 GAMMA AROUND Psi AND Psi PRIME
E. Pelaquier and F. M. Renard Jul. 1975 14 p refs
(PM/75/12) Avail: NTIS HC $3.50

The effect of decay modes Psi, Psi prime yields 3 gamma in the reaction positon negaton yields 3 gamma is discussed as a test of the quark antiquark bound state models. The energy dependence and photon spectra due to the QED diagrams were calculated together with the Psi, Psi prime contribution. The resonance width and cross sections are of the order of a few eV and 2.4 nb respectively, at the top of the Psi. ESA

N76-19932# Electric Power Research Inst., Palo Alto, Calif.
A REVIEW OF IRRADIATION-INDUCED DENSIFICATION IN URANIUM DIOXIDE FUEL
H. Ocken Sep. 1975 32 p refs
(PB-245996/4; EPRI-SR-15) Avail: NTIS HC $4.00 CSCL 18J

The evolution of the understanding of fuel densification from 1972 to 1975 was traced. Progress includes: (1) identification of microstructural features of the fuel having the greatest impact on densification; (2) establishment of in-reactor operating conditions dominating densification kinetics; (3) confirmation by theoretical models that parameters identified by experimental evident play a major role in fuel densification; and (4) assurance that stable fuels can be routinely provided by control of pellet fabrication process variables. Also, resintering tests can provide ready ex-reactor confirmation of differences between fuel types that are likely to be stable or unstable under inreactor conditions; and the irridation of stable fuel types should have a minimum impact on core performance. GRA

N76-19933# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
DETERMINATION OF EQUIVALENT DIFFUSION THEORY PARAMETERS Final Report
A. F. Henry and B. A. Worley Aug. 1975 94 p refs Sponsored by Elec. Power Res. Inst.
(PB-245999/8; EPRI-305) Avail: NTIS HC $5.00 CSCL 18K

Ideal equivalent group diffusion theory constants are defined in a rigorous manner and the failure of standard flux-weighting procedures to yield these ideal constants is discussed. An iterative scheme based upon the response matrix technique is then developed for finding improved two-group, two-dimensional equivalent group diffusion constants for symmetric assemblies. The use of these constants in a full-core criticality calculation results in a much more accurate prediction of integrated absorption rates and power densities than those predicted using the standard flux-weighted constants. GRA

N76-19934# Massachusetts Inst. of Tech., Cambridge.
MEKIN: MIT-EPRI NUCLEAR REACTOR CORE KINETICS CODE Final Report
Robert W. Bowring, John W. Stewart, Robert A. Shober, and Randal N. Sims Sep. 1975 104 p refs Sponsored by Elec. Power Res. Inst.
(Proj. 227)
(PB-246054/1; EPRI-227) Avail: NTIS HC $5.50 CSCL 18K

The computer program MEKIN provides a solution in three dimensions for the time-dependent, two-group, neutron diffusion equations and corresponding thermal-hydraulic equations that model the transient behavior of a light water moderated power reactor. The code accepts initial steady state power level, inlet coolant temperature and flow rate. It first computes the initial steady state flux and power distribution throughout the core and then the response to a user-specified transient (change in inlet flow, temperature or control rod pattern). For PWR's the code represents transient cross flow between thermal-hydraulic channels. GRA

74 OPTICS

Includes light phenomena.

N76-19935* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRONIC OPTICAL TRANSFER FUNCTION ANALYZER Patent
Edwin E. Klingman, III, inventor (to NASA) Issued 17 Feb. 1976 6 p Filed 24 Apr. 1973 Supersedes N73-22630 (11 -

13, p 1558)
(NASA-Case-MFS-21672-1; US-Patent-3,938,892; US-Patent-Appl-SN-354060; US-Patent-Class-356-124; US-Patent-Class-356-123) Avail: US Patent Office CSCL 20F

An image dissector tube is reported whose positioning coils serve as an image element addressing means. The system is useable with any optical system including visible light, other electromagnetic radiation or charged particles (ion or electrons) so long as the image dissection means is responsive to the beam in question. The optical system under test produces a real image at the image dissection surface of the image dissection means in order for readily evaluatable data to be obtained. The entire system is preferably computer controlled in order to obtain the necessary data quickly and accurately and to calculate the optical transfer function of the optical system under test on line. With this system both the modulation transfer function and the phase transfer function may be calculated. The digital computer can control the analyzer in any of several modes.
Official Gazette of the U.S. Patent Office

N76-19936 Washington Univ., Seattle.
NONRECIPROCAL INTEGRATED OPTICS Ph.D. Thesis
Ming-Jau Sun 1975 191 p
Avail: Univ. Microfilms Order No. 76-6259

Theoretical and numerical analyses of thin film waveguide mode converters and gyrators are made using coupled mode theory. The results show that a waveguide gyrator must consist of two waveguide mode converters: one with longitudinal (polar) anisotropy, the other with polar (longitudinal) magnetic gyrotropy. A gyrator structure using a layer of nematic liquid crystal on top of a magnetic garnet film seems to be preferable to others. A 100% conversion length as small as 3 mm can easily be achieved using the available materials. Either stripe magnetic domains or periodic electric circuits can be used to achieve phase matching. If the magnetic film has polar gyrotropy, then the coupling between modes of adjacent orders is strongest and increases with mode order. If the magnetic film has longitudinal gyrotropy, then the coupling between modes of the same order is strongest, and approaches a constant when the film thickness is increased. A method of measuring the refractive index and thickness of a thin film is described. Dissert. Abstr.

N76-19937 Illinois Univ., Urbana.
A NEW NANOSECOND GATED OPTICAL DETECTION SYSTEM: APPLICATION TO SPECTROCHEMICAL ANALYSIS Ph.D. Thesis
Paul Craig Dryden 1975 112 p
Avail: Univ. Microfilms Order No. 76-6751

A gated optical detection system is developed for application to signals in the 1 to 100 nanosecond range, which combines optical detection and gating into a single unit. This device is called a transient integrating detector, because it performs a true integration of the signal and can be used with transient (nonrepetitive) as well as repetitive signals. The transient integrating detector operates on the principle that when current flows into a capacitor it is integrated, so by measuring the capacitor voltage at two points in time it is possible to measure the integral of the current over that time period. In the transient integrating detector the anode current of a PM tube is integrated by the stray capacitance of the anode and the circuitry connected to it. The transient integrating detector was applied in three areas of spectrochemical analysis: in nondispersive flame atomic fluorescence; nondispersive and dispersive molecular fluorescence; and Raman spectrometry. Dissert. Abstr.

N76-19938 Stanford Univ., Palo Alto, Calif.
SURFACE ACOUSTIC WAVEGUIDES AND THEIR APPLICATION TO OPTICAL IMAGING SYSTEMS Ph.D. Thesis
Paul Louis Adams 1975 177 p
Avail: Univ. Microfilms Order No. 76-5684

Various waveguiding structures for acoustic surface waves are considered, with an emphasis upon those waveguides suited to use in surface wave electronic devices. The theory of propagation of the surface wave in the waveguide is discussed for certain guide structures. Experimental results are presented in which waveguides are successfully applied to problems in microwave signal processing and optical imaging. The theory and applications of the so-called E-field waveguide are discussed. The guide consists of a thin metal film on a piezoelectric substrate; the shorting of the piezoelectric field associated with the surface wave lowers the wave velocity and produces an effective waveguide. Fabrication of E-field waveguides on wrap-around substrates is described. Time delays of over 1 millisecond are achieved for propagation in a closed loop; the loss associated with diffraction of the surface wave is eliminated entirely, resulting in a surface wave device of exceptionally high Q. Dissert. Abstr.

N76-19939# Joint Publications Research Service, Arlington, Va.
OPTICAL METHODS OF SIGNAL PROCESSING
Viktor Dariyevich Svet 11 Feb. 1976 133 p refs Transl. into ENGLISH of the book "Opticheskiye Metody Obrabotki Signalov" (Issue 444 in Biblioteka po Automatike) Moscow, Izd. Energiya, 1971 p 2-104
(JPRS-66766) Avail: NTIS HC $6.00

The chief methods and principles of constructing optical systems for signal processing are discussed. The capabilities of simultaneous multichannel processing of large bodies of data, with simplicity and compactness of facilities, enable these methods to be used for systems of automatic monitoring and measuring parameters in both deterministic and stochastic processes. Problems of synthesizing optical systems for signal processing and their applications in automatic measuring and monitoring units are emphasized. For individual titles, see N76-19940 through N76-19942.

N76-19940 Joint Publications Research Service, Arlington, Va.
SOME PRINCIPLES OF GEOMETRICAL AND WAVE OPTICS
In its Opt. Methods of Signal Process. (JPRS-66766) 11 Feb. 1976 p 6-32 Transl. into ENGLISH of the book "Opticheskiye Metody Obrabotki Signalov" (Issue 444 in Biblioteka po Avtomatike) Moscow, Izd. Energiya, 1971 (For availability see N76-19939 10-74)

Concepts and principles of geometrical and wave optics are presented which are considered essential for the examination of optical signal processing devices. Author

N76-19941 Joint Publications Research Service, Arlington, Va.
MAIN PRINCIPLES OF OPTICAL SPATIAL FILTRATION
In its Opt. Methods of Signal Process. (JPRS-66766) 11 Feb. 1976 p 33-74 Transl. into ENGLISH of the book "Opticheskiye Metody Obrabotki Signalov" (Issue 444 in Biblioteka po Avtomatike) Moscow, Izd. Energiya, 1971 (For availability see N76-19939 10-74)

A mathematical description of a simple optical system is first presented; optical spatial filtration is then analyzed. Various operations which may be performed by optical systems are discussed, including Fourier transformation, mutual correlation, multiplication, integration and differentiation. D.M.L.

N76-19942 Joint Publications Research Service, Arlington, Va.
METHODS AND DEVICES OF OPTICAL SIGNAL PROCESSING
In its Opt. Methods of Signal Process. (JPRS-66766) 11 Feb. 1976 p 75-125 refs Transl. into ENGLISH of the book "Opticheskiye Metody Obrabotki Signalov" (Issue 444 in Biblioteka po Avtomatike) Moscow, Izd. Energiya, 1971 (For availability see N76-19939 10-74)

Optical signal processing devices described include optical spectral analyzers, optical correlators, an optical delay device, matched optical filters, analyzers of laws of probability distribution, and input and output devices. D.M.L.

N76-19943# Tubingen Univ. (West Germany). Astronomisches Inst.
INVESTIGATIONS ON THE POINT SPREAD FUNCTION AND THE MODULATION TRANSFER FUNCTION OF FRESNEL ZONE PLATES FOR VISIBLE LIGHT [UNTERSUCHUNGEN ZUM PUNKTBILD UND ZUR MODULATIONSUEBERTRAGUNGSFUNKTION FRESNELSCHER ZONENPLATTEN IM OPTISCHEN SPEKTRALBEREICH]
Henner H. Fink Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1975 212 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(Contracts BMFT-WRK-171; GfW-b2/74-SR42)
(BMFT-FB-W-75-13) Avail: NTIS HC $7.75; ZLDI, Munich DM 44.55

The monochromatic Point Spread Function (PSF) of Fresnel Zone Plates (FZP) with increasing number of zones and of both complementary types of the circular grating were measured in the focal plane of the first order of diffraction. They were compared with the corresponding intensity distributions obtained by numeric evaluation. The structure of the focal diffration pattern is discussed for different regions of the PSF. For ideal FZPs the results are transferable to the wavelength region of soft X-rays. The Modulation Transfer Function (MTF) of the FZPs is obtained by Fourier transforming (a) the PSF, (b) the measured line spread function, and (c) by comparison with a thin lens. The influence of the chromatic aberration of the FZP on the MTF is discussed for some selected spectra. The total transfer function of an X-ray camera with FZP-objective and X-ray film as an image detector was estimated. Author (ESA)

N76-19944# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOWARD KNOWLEDGE OF THE FLUORESCENCE OF MERCURY VAPOR
H. Niewodniczanski 28 Apr. 1975 24 p refs Transl. into ENGLISH from Z. Physik (West Germany), no. 4, 1929 p 59-72
(AD-A016140; FTD-HC-23-1149-75) Avail: NTIS CSCL 07/4

In connection with results of previous work, which are briefly reported here, the emission of the line at 1849 A in the fluorescence of mercury vapor was studied with negative results. The fluorescence spectrum excited with an aluminum spark was studied with mercury vapor superheated from 245 to 910C. All the lines and bands in the fluorescence spectrum become much weaker in the presence of hydrogen, except for the band with the long-wave limit at 2349 A, which remains unchanged in intensity. The carriers of these bands are deduced from the intensity curves of the fluorescence bands. The fluorescence band with its long-wave limit at 2349 A was also studied in saturated mercury vapor. Its decrease in intensity with increasing vapor density is explained through the rising band absorption, based on the absorption records. GRA

N76-19945# Washington Univ., Seattle. Dept. of Electrical Engineering.
FABRICATION OF LINEAR WAVEGUIDES AND HORN SHAPED COUPLING STRUCTURES Final Report, 15 Jul. 1973 - 14 Jul. 1974
Robert B. Smith, David G. Dalgoutte, and J. H. Harris 1 Dec. 1975 37 p refs
(Contract N00123-73-C-1200)
(AD-A016633) Avail: NTIS CSCL 20/5

Coupling light from fibers to film for example integrated optic structures requires coupling over some finite length for materials which do not cleave easily. Some form of distributed coupler familiar to microwave circuitry is required. In this sense distributed means coupling over some finite aperture in the direction of propagation typically hundreds or thousands of wavelengths. This report describes a method of generating efficient couplers which do not require precise control of physical parameters and hence relax the tolerances for coupler construction. This crossed-beta coupler requires phase match between the two waveguides at only one point. Typically, this coupler may be realized by two waveguides whose respective propagation constants (beta) change linearly for a short region and cross at the phase match point. Analytical solutions for coupler efficiency and physical dimension are given. Author (GRA)

N76-19946# Naval Electronics Lab. Center, San Diego, Calif.
INTEGRATED OPTICS COMPONENTS: FABRICATION AND TESTING Semiannual Report, 1 Oct. 1974 - 31 Mar. 1975
T. G. Pavlopoulos and D. J. Albares 1 Sep. 1975 61 p refs
(AD-A017598; NELC-TR-1964) Avail: NTIS CSCL 20/16

Integrated optics promises components which will extend the bandwidth and/or switching capabilities of fiber optics communications and provide very rapid information processing for DoD systems. The work on the program that was performed at NELC and under contracts administered by NELC was in the areas of materials for 10C substrates and devices, pattern fabrication, theoretical analysis, system concepts, and breadboard subsystem assembly. This report includes sections on Fabrication Techniques for Integrated Optical Circuits, Diode Sources for Optical Communications, GaAs-GaAlAs Double-Heterostructure Injection Lasers with Distributed Feedback, Experiments with Tapered-Channel Waveguides, Fabrication of Low-Loss Optical Waveguides by Post-Deposition Microstructure Modification, Fabrication of Tapered Waveguides, Testing of University of Washington Tapered Waveguides, Interferometric Waveguide Switch/Modulator, and Breadboard Subsystem Testing. GRA

N76-19947# Perkin-Elmer Corp., Norwalk, Conn.
SATELLITE IMAGE QUALITY SIMULATION STUDY Final Technical Report, Apr. 1974 - Mar. 1975
Bruce M. Boyce and Bob J. Knoll Aug. 1975 129 p refs
(Contract F30602-74-C-0209; DARPA Order 2646)
(AD-A017612; PE-12471; RADC-TR-75-214) Avail: NTIS CSCL 20/6

The purpose of the Satellite Image Quality Simulation was to develop a quantitative model for the relationship between the subjective quality of images of satellites obtained through a turbulent atmosphere from large ground based telescopes, and quantitative measures of the optical transfer function and noise characteristics of the image formation process. To determine this relationship, a series of images of satellites was generated in the study, in which the effects of various OTF and noise degradations were simulated. The images were viewed by a group of human observers, who were asked to estimate the subjective quality of the images, relative to a set of reference images of the same satellite having known resolution characteristics. The results of these viewing and interpretation experiments were then compared to the predictions of several image quality models; one model was found to produce a very good fit to the observed data. GRA

N76-19948# Hughes Research Labs., Malibu, Calif.
LASER WINDOW SURFACE FINISHING AND COATING SCIENCE Semiannual Technical Report, 2 Dec. 1974 - 2 Jun. 1975
M. Braunstein, S. D. Allen, A. I. Braunstein, C. R. Giuliano, and D. Zuccaro Jul. 1975 67 p refs
(Contract F19628-75-C-0135; DARPA Order 2415; AF Proj. 2415)
(AD-A017605; AFCRL-TR-75-0429; SATR-1) Avail: NTIS CSCL 20/6

The work on thorium tetrafluoride (ThF4) film preparation under ultrahigh vacuum conditions has produced films having absorption index values (K) in the range of 0.0007 to 0.0011. Surface finishing work for KCl placed emphasis on examination of various liquid etchants to determine their compatibility with pitch laps used for surface polishing. Work on the development of a modulated light ellipsometer with operating capability at 10.6 micrometers continued. Various feedback control stabilization schemes are described to provide stability to the light source and the zinc selenide photoelastic modulator used to obtain 10.6 micrometer operation. Data on the refractive index of polycrystalline zinc selenide at 10.6 micrometers as a function of angle are presented. The improvements made to the laser damage test facility are described. The range of pulse durations has been extended to cover from 0.6 microsec to 6 microsec and single longitudinal mode control consisting of a smooth temporal profile has been achieved. GRA

N76-19949# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
STRESS-OPTIC COEFFICIENTS OF KCl, BaF2, CaF2, CdTe, TI-1120, AND TI-1173 Physical Sciences Research Papers
Carl A. Pitha and Jerome D. Friedman 29 Jul. 1975 12 p refs
(AF Proj. 5621)
(AD-A017173; AFCRL-TR-75-0407; AFCRL-PSRP-639) Avail: NTIS CSCL 20/6

The stress-optic coefficients have been determined at 10.6 micrometers and 22 C for single crystal KCl and BaF2, for polycrystalline CaF2 and CdTe, and for the chalcogenide glasses TI-1120 and 1173. The method employed consists in inducing a birefringence in the isotropic specimen and determining the

coefficients from a measure of the resulting phase retardation.
Author (GRA)

N76-19950# Metavac, Inc., Flushing, N.Y.
PRODUCTION ENGINEERING MEASURES INFRARED FILTER FOR 1kW SEARCHLIGHT AN/VSS-3A Quarterly Report, 1 Jun. - 31 Aug. 1975
John Monte 30 Sep. 1975 27 p
(Contract DAAB07-74-C-0379)
(AD-A017229; QR-5) Avail: NTIS CSCL 20/6

Five Engineering Sample Filters were prepared and submitted to tests in accordance with those specified in Document C2a 2204010306 dated 27 July 1973. In particular the tests included those listed in Table I and Table II of the Specification. Rearrangement of manufacturing facilities found to be desirable for improving operation efficiency and for reducing the handling of filter components during the manufacturing process, were completed. A Manufacturing Procedure was prepared and submitted to government personnel for examination and approval. Upon receipt of acceptance of the Engineering samples and of the Manufacturing Method, work began in the fabrication of First Article Filters. Equipment suitable for routine testing of the Filters in accordance with the Specification was assembled and checked. GRA

N76-19951# New Mexico State Univ., University Park. Engineering Experiment Station.
A REAL-TIME TRACKING ALGORITHM Final Report, 23 Sep. 1974 - 31 May 1975
G. M. Flachs 25 Sep. 1975 30 p refs
(Contract DAHC04-75-G-0038)
(AD-A017228; ARO-12846.1-R-EL) Avail: NTIS CSCL 17/8

A target tracking algorithm is described that is applicable to real-time video trackers in noisy and multiple target backgrounds. The algorithm consists of fast and reliable methods for picture decomposition, initial target acquisition, multiple target tracker, and structural recognition. The algorithm can be implemented to use the speed of parallel processing techniques. GRA

N76-19109* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMA OF MODIFIED GREGORIAN AND CASSEGRAINIAN MIRROR SYSTEMS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 885-894 refs Repr. from J. Optical Soc. Am., v. 44, no. 8, Aug. 1954 p 630-633 (For availability see N76-19059 10-02)
CSCL 20F

N76-19110* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A WIDE-FIELD TELESCOPE WITH SPHERICAL OPTICS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 895-901 (For availability see N76-19059 10-02)
CSCL 20F

N76-19112* Avco-Everett Research Lab., Everett, Mass.
WIDE ANGLE LENSES WITH ASPHERIC CORRECTING SURFACES
Robert T. Jones *In* NASA. Ames Res. Center Collected Works of Robert T. Jones Feb. 1976 p 917-922 refs Sponsored in part by Air Force (For availability see N76-19059 10-02)
CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-19952 Michigan Univ., Ann Arbor.
ION CYCLOTRON INSTABILITIES IN FINITE BETA MIRROR PLASMAS Ph.D. Thesis
Taner Uckan 1975 261 p
Avail: Univ. Microfilms Order No. 75-29338

A general dispersion relation for arbitrary propagation of electrostatic and electromagnetic waves in an infinite, collisionless, weakly inhomogeneous, anisotropic high beta plasma was derived. By taking into consideration the coupling between longitudinal and transverse waves the appropriate dispersion relations for the ion cyclotron instabilities were deduced and applied to mirror-confined plasmas. A stability analysis was carried out for the flute-like drift-cone and loss-cone modes for various values of beta and electron temperature as well as other plasma parameters. Flute-like drift-cyclotron and mirror ratio-dependent drift-cone modes have also been examined for high beta effects. Utilizing a two-dimensional criterion for distinguishing absolute instabilities with arbitrary propagation, the drift-cone and loss-cone modes were examined numerically. For both cases a stabilizing effect with beta as reflected in the increase in the transition density (convective to absolute) of the order of 4 to 5 was obtained. Dissert. Abstr.

N76-19953 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE EFFECT OF HIGH MAGNETIC FIELDS ON THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN Ph.D. Thesis
Edward James Button 1975 66 p
Avail: Univ. Microfilms Order No. 76-6504

A quantum-rate analysis of laser-induced breakdown in deuterium and helium gas was used to predict the dependence of the breakdown threshold intensity on gas pressure, laser pulse length, and the magnitude of an applied external magnetic field parallel to the direction of propagation of the laser beam. Diffusion, elastic and inelastic collisions, and multiphoton ionization of atomic and molecular states excited by electron impact were considered. For gas pressures from 25 to 400 Torr and laser pulse lengths longer than one nanosecond, a first-order quantum-rate equation correctly described the laser-induced breakdown process near threshold. The threshold data indicate the presence of three distinct regions; the pulse-length-dominated, the intermediate, and the diffusion-dominated. Results show that an external magnetic field will not affect pulse-length-dominated breakdown. However, for diffusion-dominated cascade, the magnetic field inhibits the electron free diffusion rate in a direction perpendicular to the field direction, resulting in a reduction in the breakdown threshold. Dissert. Abstr.

N76-19954 California Univ., Irvine.
ION CYCLOTRON HEATING AND OPTICAL DIAGNOSTICS IN Q-MACHINE PLASMAS Ph.D. Thesis
Daniel Robert Dakin 1975 303 p
Avail: Univ. Microfilms Order No. 76-6470

The electrostatic ion cyclotron modes were investigated with emphasis on excitation by an electron current parallel to the magnetic field. By means of this instability significant ion heating in a barium plasma in a Q-machine were observed. Ion temperatures are measured optically from the Doppler broadening of resonance radiation. The linear dispersion relations for ion cyclotron modes in the electrostatic approximation are generalized for several particle distribution functions and for arbitrary direction of propagation. The electrostatic ion cyclotron modes are shown to be an efficient mechanism for coupling energy to the ions. Nearly all of the wave energy density consists of particle kinetic energy. It is shown that a broad range of perpendicular phase velocities can be excited resulting in coupling to the bulk of the ions transverse to the magnetic field. Experimental results are presented in which ion temperatures are measured as a function of a broad range of Q-machine parameters.
Dissert. Abstr.

N76-19955 Illinois Univ., Urbana.
OPTICAL EMISSION AND KINETICS OF HIGH-PRESSURE RADIATION-PRODUCED NOBLE GAS PLASMAS Ph.D. Thesis
Paul Eric Thiess 1975 863 p
Avail: Univ. Microfilms Order No. 76-6987

Measurements of the ultraviolet, visible, and near-infrared spectra and absolute atomic line and molecular band strengths were made in high-pressure (1 to 760 Torr) noble gas and noble-gas mixture plasmas produced by 5.3-MeV alpha particles. Similar measurements were also made with a radial field

superimposed in the Townsend discharge region. Major findings about excited state kinetics in radiation-produced plasmas include: (1) above a few Torr, excitation is produced initially primarily by soft secondary electrons rather than by the high energy ions, (2) with an applied radial field, two-step excitation from long-lived metastables dominates at moderate pressures (50-700 Torr), (3) for rare-gas molecular metastables this two-step excitation is dissociative, producing excited atomic species, (4) associative ionization (forming rare-gas molecular ions) depopulates higher excited atomic states and dominates over spontaneous emission above about 40 Torr, (5) associative formation of rare-gas molecular excited states from low lying atomic states occurs for all states below the molecular ion formation potential.

Dissert. Abstr.

N76-19956 Illinois Univ., Urbana.
HIGH CURRENT ION EMISSION IN ELECTROHYDRODYNAMIC SPRAYING Ph.D. Thesis
Berthold Werner Weinstein 1975 113 p
Avail: Univ. Microfilms Order No. 76-7008

The electrohydrodynamic spraying (EHD) of ions from conducting liquids at a capillary tip has traditionally been explained as field evaporation at room temperature from a very small liquid tip, of the order of 10-20 A. Consideration of the effect of space charge on the fields and force balance at the tip indicates that stable emission of the typical observed currents of 50 - 100 microamperes cannot occur from an area smaller than several microns in diameter on a naturally formed liquid tip. Experiments are presented that were conducted with EHD spraying of a GaIn eutectic alloy. Quantities measured included the number of neutral atoms emitted with the ions, the spectrum of the light which accompanies ion emission, the energy and mass spectra of the emitted ions, and the effect on the emission of secondary electrons and residual gas in the vacuum chamber. Some results for spraying from a negative polarity emitter and also for spraying of sodium iodide-glycerol are also reported.

Dissert. Abstr.

N76-19957*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
TEMPERATURE OF POWER PARTICLES IN PLASMA JETS
S. P. Polyakov, O. V. Ryazantsev, and V. I. Tverdokhlebov Washington NASA Mar. 1976 9 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 1, Jan.-Feb. 1975 p 29-33
(Contract NASw-2789)
(NASA-TT-F-16957) Avail: NTIS HC $3.50 CSCL 20I

The problem of determining the temperature of refractory particles carried along in a two phase plasma jet is discussed in connection with the use of a plasmatron for the deposition of protective metal coatings on metal parts. A method for measuring the mass average temperature of such particles and the kinetic energy which they impart to the metal surface is proposed, based on the determination of the enthalpy of the plasma with and without the refractory particles. A theoretical calculation of the errors involved in such measurements is presented, a linear calorimetric probe being used to determine the enthalpy. Results are given in the case of an air plasma stream with calcined magnesite particles 200-250 microns in diameter. Author

N76-19958# Princeton Univ., N.J. Plasma Physics Lab.
BOHM STABILITY CRITERION AND THE MHD THEORY OF PLASMA FLOW INTO AN ABSORBING WALL
A. H. Boozer Aug. 1975 9 p
(Contract AT(11-1)-3073)
(MATT-1148) Avail: NTIS HC $4.00

The consistency of the Bohm stability criterion and the magnetohydrodynamic (MHD) theory of plasma flow into an absorbing wall is shown. This provides strong evidence for the validity of an MHD analysis of the complex problem of plasma flow into a divertor. Author (NSA)

N76-19959# Sydney Univ. (Australia). School of Physics.
TEMPERATURE AND DENSITY PROFILES OF AN MHD SWITCH-ON SHOCK
C. N. Watson-Munro, L. Bighel, A. R. Collins, N. F. Cramer, and R. C. Cross Feb. 1975 15 p
(NP-20524; ER-80) Avail: ERDA Depository Libraries HC $4.00

An experimental study of the structure of MHD switch-on shock waves propagating into partially ionized hydrogen and helium plasmas is described. The variation of electron and ion temperatures through the shock front was studied as a function of the level of preionization. When the shock propagates into an almost fully ionized plasma, the electron temperature rises well above the ion temperature due to resistive heating of the electrons. At low preionization levels however, the ion temperature rises above the electron temperature. These results indicate that ion-neutral collisions can play a dominant role in the dissipation of energy in a shock wave. Author (NSA)

N76-19960# Los Alamos Scientific Lab., N.Mex.
INTENSE NEUTRON SOURCE FACILITY FOR THE FUSION ENERGY PROGRAM
D. D. Armstrong, C. R. Emigh, K. L. Meier, E. A. Meyer, and J. D. Schneider 1975 51 p refs Presented at Intern. Conf. on Radiation Test Facilities for the CTR Surface and Mater. Program, Argonne, Ill., 15 Jul. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1262; Conf-750723-8) Avail: NTIS HC $5.75

The intense neutron source is based on the ability of a supersonic flow of gas to dissipate an enormous quantity of heat generated in the neutron-producing target by multiple Coulomb collisions. A description is given of the principles involved in forming the supersonic jet, and in forming the intense tritium-ion beam in the vacuum systems and in the tritium handling systems. An overview of the entire facility is included. It is believed that the facility can be operated with high reliability, ensuring a productive radiation damage program. NSA

N76-19961# California Univ., Livermore. Lawrence Livermore Lab.
RECENT EXPERIMENTS ON THE 2XIIB MIRROR MACHINE
F. H. Coensgen, W. F. Cummins, B. G. Logan, A. W. Molvik, W. E. Nexsen, T. C. Simonen, B. W. Stallard, and W. C. Turner 25 Aug. 1975 9 p refs Presented at the 7th European Conf. on Controlled Fusion and Plasma Physics, Switzerland, 1-5 Sep. 1975 Sponsored by ERDA
(UCRL-77255) Avail: NTIS HC $4.00

Plasma confinement experiments with neutral beam injection in the 2XIIB magnetic mirror facility are described. Ion heating to 13 keV and build-up of hot ion densities to 4 x 10 to 13th power/cu cm are measured when streaming plasma is introduced to suppress microinstabilities. Increasing ion energy is found to increase n tau. Author (NSA)

N76-19962# California Univ., Livermore. Lawrence Livermore Lab.
RECENT MIRROR MACHINE RESULTS AND THEIR IMPLICATIONS FOR MIRROR SYSTEMS
R. F. Post 15 Aug. 1975 11 p refs Presented at the 7th European Conf. on Controlled Fusion and Plasma Physics, Switzerland, 1-5 Sep. 1975 Sponsored by ERDA
(UCRL-77221; Conf-750905-16) Avail: NTIS HC $4.00

Improved confinement recently achieved in the Livermore 2XIIB experiment is interpreted in terms of warm plasma stabilization of the drift-cone mode. The same theoretical model explains present and earlier mirror observations and also predicts improved prospects for achieving classical plasma loss rates in mirror fusion reactors. Author (NSA)

N76-19963# Los Alamos Scientific Lab., N.Mex.
STAGED THETA PINCH EXPERIMENTS
R. K. Linford, J. N. Downing, R. F. Gribble, A. R. Jacobson, D. A. Platts, and K. S. Thomas 1975 5 p refs Presented at 7th European Conf. on Controlled Fusion and Plasma Phys., Lausanne, Switz., 1-5 Sep. 1975 Sponsored by ERDA
(LA-UR-75-905; Conf-750905-18) Avail: NTIS HC $4.00

Two concepts are presented for producing theta pinch plasmas with larger ratios of plasma radius to discharge tube radius than are produced in standard theta pinches. The experiments for testing these concepts and preliminary results are described.

Author (NSA)

N76-19964# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
A METHOD FOR MEASURING THE FIELD-INDEX IN A TOKAMAK
P. C. T. VanDerLaan Apr. 1975 6 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-75-89) Avail: NTIS HC $3.50

Various types of coils with which the field-index of the vertical field in a Tokamak can be measured are described. Other applications of the described coils are: a measurement of the radius of curvature of a general vacuum field, a measurement of the derivative of the field along the field lines, and a measurement of the field penetrating a hollow cylinder.
Author (ESA)

N76-19965# Illinois Univ., Urbana.
CONFERENCE PROCEEDINGS: EFFECT OF CYCLOTRON EMISSION OF THE POWER BALANCE IN FUSION SYSTEMS
G. M. Miley Sep. 1975 72 p refs Workshop held at Palo Alto, Calif., 3-4 Mar. 1975; sponsored by Elec. Power Res. Inst.
(PB-245997/2; EPRI-SR-16) Avail: NTIS HC $4.50 CSCL 18A

Some specific topics in theory such as the effect of collective phenomena on emission are suggested. Continued development of comprehensive codes to treat emission-transport phenomena in nonuniform plasmas with realistic geometries are encouraged. It is noted that exploratory studies of new confinement concepts that may be uniquely suited to advanced-fuel operation are needed.
GRA

N76-19966# Tel-Aviv Univ. (Israel).
ELECTRONIC ENERGY TRANSFER IN GAS MIXTURES Final Scientific Report, 1 Jul. 1974 - 30 Jun. 1975
R. Shuker, Y. Binur, and A. Szoke 30 Jun. 1975 27 p refs (Grant AF-AFOSR-2518-73)
(AD-A016053; AFOSR-75-1368TR) Avail: NTIS CSCL 07/4

Time resolved spectroscopy of He/CO discharges shows that helium transfers electronic excitation energy via Penning ionization and charge exchange yielding CO(+)(B). Dissociation of CO is unimportant. A computer simulation of the current pulse is described and used for pure helium discharge. The program is listed. The results show the time dependence of the current and the electron density and temperature. The model used is simplified to include only two plasma processes, i.e. ionization and recombination. It incorporates velocity averaged ionization cross-section. Work on afterflow in Ar/CO and Ar/Kr systems is also mentioned.
GRA

N76-19967# Emory Univ., Atlanta, Ga.
SOME NOVEL DIAGNOSTIC TECHNIQUES FOR PLASMA CHEMISTRY
Myron Kaufman 15 Oct. 1975 31 p refs
(Contract N00014-75-C-0200)
(AD-A017643; TR-10) Avail: NTIS CSCL 07/3

In order to probe the mechanisms of chemical transformations in electric discharges it is most useful to monitor concentrations of reactants, products and reactive intermediates as a function of discharge parameters. Mass spectrometry, a popular technique for observing intermediates in chemical reactions, meets with particular difficulty when applied to discharges, due to the presence of excited molecules as well as free radicals in such systems. Molecular beam analysis, a synthesis of mass spectrometry with molecular beam measurements of electric and magnetic moments and velocity distributions, is a technique developed in our laboratory which offers distinct advantages for the analysis of intermediates in electric discharges. A chromatographic sampling system which employs compression in order to achieve high sensitivity has been developed and evaluated. We are also, investigating the use of discharge 'actinometers' as means of measuring the intensity of electric discharges.
GRA

N76-19968# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECT OF HIGH MAGNETIC FIELDS ON THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN Ph.D. Thesis. Final Report
Edward J. Button Feb. 1975 69 p refs
(AF Proj. 8809)
(AD-A017179; DS/PH/75-1) Avail: NTIS CSCL 20/9

A quantum-rate analysis of laser-induced breakdown in deuterium and helium gas was used to predict the dependence of the breakdown threshold intensity on gas pressure, laser pulse length, and the magnitude of an applied external magnetic field parallel to the direction of propagation of the laser beam. Diffusion, elastic and inelastic collisions, and multiphoton ionization of atomic and molecular states excited by electron impact were considered.
GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-19969 Stanford Univ., Calif.
OBSERVATION OF NUCLEAR QUADRUPOLE RESONANCE WITH SUPERCONDUCTING MAGNETOMETERS Ph.D. Thesis
Terrence James Jach 1975 105 p
Avail: Univ. Microfilms Order No. 76-5746

The experiment is a completely new way to observe pure nuclear quadrupole resonances. The basic principle is to invert the populations of two nuclear quadrupole levels, using the technique of adiabatic fast passage. The resulting change in the magnetic moment of the crystal, along the axis of its electric field gradient, is measured with a Josephson junction magnetometer. A magnetic field, of the order of the local nuclear magnetic field in the crystal, is imposed along the axis of the electric field gradient in order to remove the degeneracy of the states. A sample crystal of sapphire (aluminum oxide) was used. Both the 3/2-5/2 and the 1/2-3/2 resonances of aluminum were observed. These occurred at 717 kilohertz and 359 kilohertz. A spin-lattice relaxation time of one hundred seconds was measured directly.
Dissert. Abstr.

N76-19970 Illinois Univ., Urbana.
THIN-FILM SEMICONDUCTOR DETECTORS FOR 10.6 MICROMETERS RADIATION Ph.D. Thesis
John Christian Zimmerman 1975 142 p
Avail: Univ. Microfilms Order No. 76-7023

Thin film semiconductor detectors were investigated for use as room temperature thermal detectors for infrared radiation at 10.6 microns. Some of the materials investigated were antimony trisulfide, germanium, tellurium, and selenium. The most successful devices were fabricated from 400 A bismuth, 6800 A selenium, and 1500 A gold on an alumina substrate. The method of operation was also studied and it was found that devices operating in the avalanche region of the Schottky diode formed between selenium and bismuth provided the best responsivity and frequency response. The responsivity of the device was measured as a function of the geometry and the modulation frequency. A responsivity of 15 mV/W was observed at a modulation frequency of 1000 KHz using the above detector. A comprehensive thermal analysis of thin film thermal detectors was made and a computer program written to calculate the responsivity of arbitrary devices.
Dissert. Abstr.

N76-19971 Cornell Univ., Ithaca, N.Y.
BAND STRUCTURE OF HIGHLY COMPRESSED HYDROGEN Ph.D. Thesis
Carlos Friedli 1975 110 p
Avail: Univ. Microfilms Order No. 76-5939

The band structure of solid molecular hydrogen is calculated for several values of the lattice parameter 'a'. The range of 'a' includes the high density regime in which it is generally believed the transition to the metallic phase occurs (about 8 to 10 times the normal density). The method used combines plane wave and localized orbital features. Its advantages over the Korringa-Kohn-Rostoker (KKR) and pure plane wave (PW) expansion methods, which were also used, are discussed. The results obtained with the KKR and PW methods, however, provide valuable information on nonspherical and orientational aspects

of the molecules in the solid. Although the combined representation method was used to obtain the bands for the Pa3 or alpha-nitrogen structure, it is applicable to other structures as well and can be readily adapted to self-consistent calculations. The bands obtained show a marked free electron character above 5 to 6 times the normal density, and the energy gap disappears at 9.15 times the normal density (r sub s = 1.48).
Dissert. Abstr.

N76-19972 Illinois Univ., Urbana.
THE SPECIFIC HEAT AND RESISTIVITY OF SEVERAL AMORPHOUS SUPERCONDUCTING THIN FILMS Ph.D. Thesis
Edward Lawrence Griffin 1975 95 p
Avail: Univ. Microfilms Order No. 76-6772

A new apparatus is described which allows the measurement of the resistivity and heat capacity of thin film superconductors. The heat capacity is measured using an ac technique with a sensitivity of 5 micro erg/K at 1K with a temperature oscillation of 1mK. Data are presented for several amorphous Sb(.6)Bi, Ge(.55)Ag and Ge(.65)Ag superconducting films. The heat capacity is found to be well described by Debye theye below 1.5K. The excess heat capacity and resistivity were found to be in agreement with the theories of Maki-Thompson and Ferrell, although some deviation was ascribed to sample inhomogeneity. Small peaks were observed in the excess heat capacity below the transition temperature. These are believed to be due to intrinsic peaking in the excess heat capacity as predicted by Rickayzen and Bray, although the peaks observed were about one-fifth the size predicted. Dissert. Abstr.

N76-19973 Stanford Univ., Calif.
THERMAL PROPERTIES OF METALS WITH LOW TEMPERATURE STRUCTURAL INSTABILITIES Ph.D. Thesis
James McKell Edwin Harper 1975 147 p
Avail: Univ. Microfilms Order No. 76-5738

To examine the low temperature properties of these materials, a calorimeter was designed and constructed capable of performing both accurate absolute heat capacity measurements and high resolution relative heat capacity measurements on samples as small as a few milligrams over the temperature range 4 K to 300 K. Two high transition temperature superconductors of the A15 structure were studied, niobium-tin and niobium-germanium. The lattice transformation at 41 K in niobium-tin was examined with high resolution calorimetry to determine its relationship to the 17.8 K superconducting transition. The superconducting transition was found to correspond to the low temperature tetragonal phase of niobium-tin, with no unusual effects due to sample size. Developments in chemical-vapor-deposition techniques made it possible to measure the heat capacity of thin films of niobium-germanium. Dissert. Abstr.

N76-19974 Rhode Island Univ., Kingston.
STUDIES IN SOLID STATE IMAGE SENSORS Ph.D. Thesis
Konstantinos Nikolaou Anagnostopoulos 1975 168 p
Avail: Univ. Microfilms Order No. 76-4963

Element silicon image sensor arrays, utilizing the photodiode-bipolar transistor (PBT) element, were fabricated, tested and scanned in a television raster. The spike noise cancellation scheme inherent in the PBT element was effectively utilized in the area arrays to reduce the peak value of the spike noise by more than an order of magnitude and to increase the peak value of the video signal. The circuit analysis was performed using ECAP-1620. The photodiode was modeled by a nonlinear capacitor and the transistor by a modified M-equivalent circuit. The variation of the base-emitter junction resistance and voltage drop with forward bias and the variation of the transistor gain with base current were included in the model. The effect of all the elements of the array on the video signals was taken into account. Very good agreement was obtained between the calculated and experimental results. Dissert. Abstr.

N76-19975 Alabama Univ., University.
A DIRECT DETERMINATION OF THE MICROWAVE MAGNETIC FIELD Ph.D. Thesis
Andrew S. Jones, Jr. 1975 79 p
Avail: Univ. Microfilms Order No. 76-4822

The splitting of a negative ENDOR line by an intense microwave field in an X-ray irradiated single crystal of N-acetyl-glycine was studied. This splitting was shown to arise as a direct result of the microwave magnetic field, H sub 2, in the cavity. Basic quantum mechanical considerations predict a splitting of magnitude g Beta H sub2/2h. Based on this result, a technique is demonstrated for determining the microwave field in the cavity at the sample site. As an example of the above technique for the microwave field determination, the spin-lattice relaxation time, T sub 1, was estimated for DPPH using the power saturation method. The values of T sub 1, obtained in this manner are larger by an order of magnitude than the previously published values. This difference is attributed to the difference in the method used to determine the microwave field strength. Dissert. Abstr.

N76-19976*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE LATTICE PARAMETERS OF NOHSO4 AND NOH2O7
Carl-Friedich Linstroem and Joachim Loescher Washington NASA Feb. 1976 7 p refs Transl. into ENGLISH from Z. Chem. (East Germany), v. 9, 1969 p 353-354
(Contract NASw-2789)
(NASA-TT-F-16880) Avail: NTIS HC $3.50 CSCL 20L

Data are lacking on the crystal system, the magnitude of the lattice parameters and the Miller indices of individual X-ray interferences. The positions and intensities of X-ray reflections were measured by using Ni-filtered copper radiation. Peak heights were used to determine the relative intensities and the peak height of the strongest line was set equal to 10. Graphically determined Miller indices were used for refining the lattice parameters by means of a compensation calculation. Lattice parameter errors may result in the line indices being incorrect at the greater interference angles. Author

N76-19977*# South Carolina State Coll., Orangeburg.
THE CRITICAL CURRENTS IN SUPERCONDUCTING TIN FILMS Final Report, 1 Jul. 1973 - 14 Mar. 1976
James E. Payne 14 Mar. 1976 12 p ref
(Grant NsG-8021)
(NASA-CR-146436) Avail: NTIS HC $3.50 CSCL 20L

The nonlinear current-voltage curves exhibited by tin films in the flux flow state have made studies of the amount of heating present in the sample necessary. The samples in this work consisted of an evaporated tin film on one side of a 2 mm thick crystal quartz substrate and a carbon film of the same configuration as the tin film on the back of the substrate. The carbon film was used as a thermometer to measure the temperature rise of the tin film above the bath temperature. The heating results indicate negligible effects in the samples. Temperature ratios as small as 0.80 for the tin samples have been investigated and the current-voltage characteristics are still nonlinear, indicating that the source of the nonlinearity is not Joule heating in the samples. Author

N76-19978*# University of Southern Calif., Los Angeles. Dept. of Chemical Engineering.
ANALYTICS OF CRYSTAL GROWTH IN SPACE Final Report, 5 Dec. 1974 - 17 Dec. 1975
Chong E. Chang, Robert A. Lefever, and William R. Wilcox Dec. 1975 74 p refs
(Contract NAS8-29847)
(NASA-CR-144214) Avail: NTIS HC $4.50 CSCL 20B

The variation of radial impurity distribution induced by surface tension driven flow increases as the zone length decreases in silicon crystals grown by floating zone melting. In combined buoyancy driven and surface tension driven convection at the gravity of earth, the buoyancy contribution becomes relatively smaller as the zone diameter decreases and eventually convection is dominated by the surface tension driven flow (in the case of silicon, for zones of less than about 0.8 cm in diameter). Preliminary calculations for sapphire suggest the presence of an oscillatory surface tension driven convection as a result of an unstable melt surface temperature that results when the zone is heated by a radiation heater. Author

N76-19979# Los Alamos Scientific Lab., N.Mex.
OBSERVATIONS OF ASYMMETRY EFFECTS IN THE VELOCITY OF DESTRUCTION OF SUPERCONDUCTIVITY BY CURRENT IN TYPE 2 Ta WIRES

W. C. Overton, Jr., H. Weinstock, and A. F. Schuch 1975 5 p refs Presented at 14th Intern. Conf. on Low Temp. Phys., Leiden, 14 Aug. 1975
(Contract W-7405-eng-36)
(LA-UR-75-750; Conf-750811-2) Avail: NTIS HC $4.00

The results of experiments on type-2 Ta wires of 0.0254 cm diameter immersed in a liquid helium bath at a temperature between 2 K and T/sub c/ are reported. The velocities of thermal propagation were measured for both forward and reverse current directions and new effects were observed. The velocity in the parallel case is significantly higher than in the antiparallel case. NSA

N76-19980# Los Alamos Scientific Lab., N.Mex.
INVESTIGATION OF THE SOURCES OF ASYMMETRY EFFECTS IN THE VELOCITY OF DESTRUCTION OF SUPERCONDUCTIVITY BY CURRENT IN TYPE 2 Ta WIRES
W. C. Overton, Jr. 1975 5 p refs Presented at 14th Intern. Conf. on Low Temp. Phys., Leiden, 14 Aug. 1975
(Contract W-7405-eng-36)
(LA-UR-75-751; Conf-750811-1) Avail: NTIS HC $4.00

The phenomenological theories for the velocity of destruction of superconductivity by current can be improved by taking into account the temperature dependences of the thermal conductivities and specific heats. It is found that the asymmetry in 'dirty' type-2 Tantalum wires can be tentatively explained by using the above mentioned parameters. Calculations were performed to determine asymmetry and are given. Author (NSA)

N76-19981# California Univ., Berkeley. Lawrence Berkeley Lab.
LOW FREQUENCY NOISE IN JOSEPHSON JUNCTIONS
J. Clarke and G. Hawkins May 1975 5 p refs Presented at 4th Intern. Conf. on Phys. Aspects of Noise in Solid State Devices Nordwijerhout, Neth., 9 Sep. 1975
(Contract W-7405-eng-48)
(LBL-3593; Conf-750937-1) Avail: NTIS HC $4.00

The low frequency power spectrum of voltage fluctuations in shunted Josephson tunnel junctions biased with a constant current I greater than the junction critical current I/sub c/ was measured. It was found that the frequency dependence of the power spectrum is very nearly 1/f and that the amplitude of the spectrum is quantitatively predicted by a suitable modification of the semi-empirical formula of Clark and Voss in Phys. Lett.; 33:24(1974). NSA

N76-19982# McDonnell-Douglas Corp., Huntington Beach, Calif.
RADIATION EFFECT ON GaAs INTERFACE Final Report, Feb. 1974 - Aug. 1975
Rainer Zuleeg and Kurt Lehovec May 1975 73 p refs
(Contract F19628-74-C-0129; AF Proj. 6096)
(AD-A015767; AFCRL-TR-75-0304) Avail: NTIS CSCL 09/1

The C-V and Q-V technique was applied to the study of interface charge distributions of GaAs epitaxial layers grown on semi-insulating substrates. Changes of mobility and free carrier concentration in the epitaxial layer and extending through the interface into the substrate were determined before and after exposure to a neutron fluence of 2.7 x 10 to the 15th power n/sq cm and a total dose of ionizing radiation of 10 to the 8th power rad (GaAs). Changes at the interface and in the epitaxial layer are correlated with the voltage-current characteristic variations of the GaAs junction field-effect transistors. GRA

N76-19983# Pennsylvania State Univ., University Park. Applied Research Lab.
THE LATTICE DYNAMICS OF ZINC FROM A GENERALIZED FIRST PRINCIPLES PSEUDOPOTENTIAL APPROACH
Janda K. G. Panitz 26 Feb. 1975 177 p refs
(Contract N00017-73-C-1418)
(AD-A016821; TM-75-37) Avail: NTIS CSCL 20/2

The elastic shear constants, and phonon dispersion curves in three symmetry directions, are calculated for zinc and compared to experimental values. Harrison's generalized first principle pseudopotential theory in the second order, nonlocal form is used to calculate the electron gas modified ion-ion interaction energy. This 'generalized' pseudopotential method is applicable to d-band metals in that the usual small core approximation is relaxed so as to effectively include the effects of hybridization. The effects of including and ignoring hybridization are compared. The delocalized nature of the metallic d-states is also considered in the calculation of the conduction-core exchange energy. Good agreement between theory and experiment is obtained for the phonon spectra curves. Agreement between theory and experiment for the elastic shear constants is fair. Author (GRA)

N76-19984# Harry Diamond Labs., Adelphi, Md.
DETERMINING WAVE FUNCTIONS FROM g FACTORS
Nick Karayianis Oct. 1975 35 p refs
(DA Proj. 1T1-61102-A-34A)
(AD-A017446; HDL-TR-1680) Avail: NTIS CSCL 07/4

EPR measurements that determine g factors for Kramers doublet states are usually reported in the literature, together with wave functions deduced from the data. Since most experiments just determine magnitudes for the g factors, they are often erroneously assumed to be positive and all wave functions consistent with the data are not obtained. This deficiency has led to incorrect or unwarranted conclusions in several instances. Formulas are given in this report for calculating all of the wave functions in those cases where one can assume linear combinations of Russell-Saunders wave functions with real coefficients and where g factors are sufficient to determine the coefficients. GRA

N76-19985# Naval Surface Weapons Center, White Oak, Md.
CLUSTER CALCULATIONS OF THE EFFECTS OF LOCAL BONDING ON THE ELECTRONIC PROPERTIES OF B6 OCTAHEDRA
L. A. Hemstreet Jun. 1975 36 p refs
(AD-A017371; NSWC/WOL/TR-75-129) Avail: NTIS CSCL 07/4

B6 octahedra, which consist of six boron atoms in an octahedral arrangement, are important structural units in such materials as the metal hexaborides and the recently discovered boron-metal WANGNOL alloys. The X(alpha) Scattered Wave Method has been used to calculate the electronic properties of both an isolated octahedron and the effects of external environment. The latter has been investigated by surrounding a B6 octahedron by various configurations of atoms representing the local structure of the metal hexaboride and alloy materials. Results obtained from these calculations have been used to provide an explanation of the difference in properties between the metal hexaborides and the WANGOL alloys in terms of the difference in local bonding properties of the two materials. The bonding in the metal hexaborides is shown to be primarily ionic-covalent, while that of the WANGNOL alloys is found to be more ionic-metallic. This difference in bonding is shown to lead to quite different electronic and mechanical properties in the two classes of materials. GRA

N76-19986# Oklahoma State Univ., Stillwater. Dept. of Physics.
EXCITON DYNAMICS AND HOST SENSITIZED ENERGY TRANSFER IN INORGANIC CRYSTALS Final Report, 15 Sep. 1974 - 14 Sep. 1975
George C. Powell, Chang Hsu, and George E. Venikouas 30 Sep. 1975 92 p refs
(Contract DAHC04-74-G-0202)
(AD-A017559; ARO-10609.6-P) Avail: NTIS CSCL 07/4

Tunable dye laser spectroscopy was used to study energy transfer processes in CaWO4:Sm(3+) crystals. Fluorescence and excitation transitions for samarium ions in different crystal field sites in calcium tungstate were identified and used to study energy migration among samarium ions as a function of temperature, samarium concentration, time after the laser pulse, and pressure. The interaction mechanism causing energy migration is identified as electric quadrupole-quadrupole. At low temperatures only single step transfer between nearby ions takes place while at high temperatures multistep diffusion occurs efficiently. GRA

N76-19987# Alabama Univ., University. Dept. of Physics and Astronomy.
CHARACTERIZATION OF SURFACES ON AN ATOMIC SCALE BY FIELD IONIZATION ENERGY SPECTRA Final Report

Andrew J. Jason and Albert C. Parr 1 Aug. 1975 47 p refs
(Grant AF-AFOSR-2726-74; ARPA Order 2780; AF Proj. 9761)
(AD-A017624; AFOSR-75-1463TR) Avail: NTIS CSCL 07/4

Field ionization energy spectra of ions produced at a metallic surface are studied in order to relate the distributions in energy to surface properties. The technique provides information about the mechanical and electronic properties of the surface on the level of single surface atoms. Instrumentation details are discussed and experimental results of the project given. Examples of energy distributions are given and the experimental relationship between distributions and imaging gas properties is discussed. GRA

N76-19988# Case Western Reserve Univ., Cleveland, Ohio. Depts. of Macromolecular Science and Chemistry.

THE ROOM TEMPERATURE CRYSTAL STRUCTURE OF 2-ETHYLBENZIMIDAZOLE

Che-Hsiung Hsu, M. H. Litt, and H. W. Chen 13 Nov. 1975 28 p refs
(Contract N00014-67-A-0404-0011)
(AD-A017644; TR-4) Avail: NTIS CSCL 07/4

The crystal and molecular structure of 2-ethylbenzimidazole was determined by three dimensional single-crystal X ray analysis. Results show that there are crystallographically independent molecules in the unit cell. The benzimidazole ring is planar. The hydrogen bonds which link the molecules together were studied. Author (GRA)

N76-19989# International Business Machines Corp., Hopewell Junction, N.Y.

DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 1 Jan. - 30 Jun. 1975

G. H. Schwuttke 1 Jul. 1975 65 p refs
(Contract DAHC15-72-C-0274; ARPA Order 2196)
(AD-A017400; TR-6; TR-22.1921) Avail: NTIS CSCL 20/12

This report describes work dealing with improvements of advanced measurement techniques. Chapter 1 deals with the computer generation of Kikuchi patterns needed for complex structural analysis of crystal defects in silicon. The program is applicable to a large variety of problems and can be used to generate Kikuchi maps for different crystal structures, each desired crystal orientation, and electron energy. The program can also be used to generate channeling patterns for scanning electron microscopy application. The report provides a complete set of computer-generated Kikuchi maps for silicon and 200 keV electrons. A complete program in Fortran IV using an IBM 1800 computer is also given. The second part describes the application of MOS C-V and MOS G-V measurements for the evaluation of epitaxial films on silicon or insulator substrates. It is shown that the presence of an underlying junction requires important precautions with use of the MOS C-V measurement technique. The junction requires an increased number of components in the equivalent network, which impedes the analysis. This chapter shows how to solve the problem. Values for MOS dot diameter, layer and substrate resistivity, oxide thickness, etc. are given and refer to ranges where meaningful lifetime measurements can be carried out. GRA

N76-19990# Harry Diamond Labs., Adelphi, Md.

SOME TEMPERATURE ASPECTS OF MOV MATERIALS

Josip J. Soln and Margaret G. Fix Sep. 1975 22 p refs Sponsored by DNA
(HDL Proj. E044E6; DNA Proj. NWED-QAXEB099)
(AD-A017488; HDL-TM-75-11) Avail: NTIS CSCL 20/12

The parameters N and Vc enter into the curves of the DD GE-MOV(TM) material as functions of temperature in the range from 0 to 2000 C, where the 1-V curves are defined as 1 = 1o times (V/Vc) to the Nth power. Both N and Vc are strongly temperature-dependent; the slopes of Vc and N are almost the same in the region above 50 C. At about 50 C, both N and Vc show a distinct break in otherwise smooth curves. The breaks in these curves probably indicate some internal changes in the material. The simple computer simulation of the output voltage using the equivalent circuit of the MOV material shows that the temperature effects of Vc and N tend to cancel each other, thus providing reasonable clamping capability throughout the whole temperature range. Author (GRA)

N76-19991# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

MAGNETIC PROPERTIES OF SUPERCONDUCTING LAYERED COMPOUNDS Interim Report

Daniel Ethan Prober Sep. 1975 198 p refs
(Contracts N00014-76-C-0032; Grants DAHC15-73-G-16; NSF DMR-72-03020; NSF GH-34133X; NR Proj. 318-003)
(AD-A017613; TR-10) Avail: NTIS CSCL 20/12

The results of an investigation of the fluctuation-induced diamagnetism and upper critical fields of superconducting layered compounds are presented. Compounds studied include TaS2 and TaS(1.6)Se(0.4) intercalated with collidine, pyridine, or aniline, having layer separations of 3, 6, and 12 A respectively, and the unintercalated compounds TaS(1.6)Se(0.4) and NbSe2. Susceptibility above T sub c for TaS2(pyridine)1/2 and NbSe2 was measured in fields up to 300 G with a superconducting quantum magnetometer. Extensive measurements of (H sub C2) as a function of field orientation and temperature were made with an ac susceptibility technique, in fields to 120 kG. The critical field anisotropy however, is found to depend only weakly on the separation between metallic layers. GRA

N76-19992# Intelcom Rad Tech, San Diego, Calif.

RADIATION EFFECTS AND MATERIAL STUDIES IN PbSnTe Final Report

H. T. Harper, C. E. Mallon, B. A. Green, and R. E. Leadon 25 Sep. 1975 168 p refs
(Contract N00014-73-C-0013)
(AD-A017451; INTEL-RT-8040-005) Avail: NTIS CSCL 20/12

The electrical and optical properties of Pb(1-x)Sn(x)Te were measured before, during, and after various electron, gamma, and neutron irradiations, and during the subsequent isochronal annealing. Irradiations of n- and p-type materials were made at 10 and 80K. At 10K, carrier removal and mobility decreases were observed during electron irradiations of p-type samples, while carrier addition and mobility increases were seen in n-type material. These results and others were consistently explained in terms of a mixed defect introduction model that was developed. Carrier lifetime studies indicated that the lifetime in an n-type sample was less than 10 to the minus 7th power sec at 80K and increased to about 0.000003 sec at 10K. Temperature dependence measurements indicate that the lifetime in the n-type sample was controlled by radiative recombination. Correlating the radiation damage as a function of irradiating particles was pursued to provide a means of predicting the relative damage to be expected in various environments. GRA

N76-19993# Carnegie-Mellon Univ., Pittsburgh, Pa.

BASIC SEMICONDUCTOR HETEROJUNCTION STUDIES Final Report, 1 Oct. 1971 - 31 Dec. 1974

D. L. Feucht and A. G. Milnes 29 Aug. 1975 52 p refs
(Grant DA-ARO(D)-31-124-72-G33)
(AD-A017177; ARO-3397.28-EL) Avail: NTIS CSCL 20/12

Heterojunction structures of pGe-nGaAs and pGe-nAlGaAs prepared by a GeI2 disproportionation growth process have been examined. Also studied have been nAlGaAs-pGaAs and AlGaSb-GaSb structures prepared by liquid-phase epitaxy. Such heterojunctions have application to injection lasers, solar cells, cold cathodes and infrared photocathodes. In support of the studies, information was obtained on the growth and characterization of AlGaSb and on the minority carrier diffusion length in GaAs. The electrical and photoluminescent properties of ZnSe, which has a close lattice match to Ge and GaAs, were also studied. GRA

N76-19994# Naval Underwater Systems Center, New London, Conn.

NONLINEAR THEORY FOR A THIN-WALLED PIEZOELECTRIC CERAMIC RING EXCITED IN THE RADIAL BREATHING MODE

Russell W. Dunham 3 Sep. 1975 45 p refs
(NUSC Proj. A-700-19; RR0220601)
(AD-A017060; NUSC-TR-4971) Avail: NTIS CSCL 20/12

The nonlinear differential equation governing a thin-walled piezoelectric ceramic ring excited in the radial breathing mode is derived from the field equation of motion for an elastic continuum, the expanded nonlinear constitutive equations, and

the appropriate boundary conditions on the stress. A somewhat pedagogic development of fundamental analytic concepts, such as tensors, tensor manipulations, and coordinate systems, is first presented to fix these necessary concepts clearly in mind. The elastic field equation is derived from basic concepts, and the general definition of strain is presented. The appropriate coordinate transformations, from spatially fixed Cartesian to materially embedded cylindrical, are demonstrated. Then the explicit nonlinear differential equation is derived to the next higher order from linear. It was assumed that the elastic nonlinearities were separable because of the typically high Q's (approximately 1000) for the suspended rings dealt with. A perturbation solution is presented displaying analytically the dependence of the second harmonic on the nonlinear elastic parameters. In the concluding comments suggestions are made as to how the elastic and electrical nonlinear parameters might be measured. GRA

N76-19995# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DETECTING IMPURITY LEVELS IN GaAs USING ELECTROREFLECTANCE M.S. Thesis

Charles A. Douglas, III Jun. 1975 91 p refs

(AD-A017181; GEO/PH/75-2) Avail: NTIS CSCL 20/12

The monitoring of the implantation process is the topic of this study. Surface barrier electroreflectance (ER) measurements on the fundamental edge of both melt-doped and ion-implanted gallium arsenide (GaAs) at 300K, using the field-effect technique, reveal structure related to impurity energy levels. Comparison of ER curves of epitaxial, as-grown, melt-doped, and ion-implanted GaAs shows the broadening of the lineshape due to the presence of impurities. Silicon, chromium, cadmium, tellurium, zinc, and tin impurities in melt-doped GaAs and tellurium, sulfur, cadmium, and zinc impurities in ion-implanted GaAs are related to structure in the ER spectrum. The effect of varying modulated voltage, DC bias, impurity concentration, and annealing on the ER spectrum of GaAs is reported. GRA

N76-19996# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PULSED CATHODOLUMINESCENCE OF ION-IMPLANTED ZnO M.S. Thesis

Courtney R. Daniels, Jr. Mar. 1975 67 p refs

(AD-A017218; GEP/PH/75-3) Avail: NTIS CSCL 20/12

A cathodoluminescence system was modified to enable pulsed operation of the electron gun and detection of the time dependent luminescence. Time resolved spectra and intensity decay curves as well as continuous excitation spectra of some previously reported violet, green, and red peaks in the cathodoluminescence of ZnO were made. The resulting observed shifts in wavelength of the violet peaks with time suggests a bound-to-bound transition. The absence of any change in decay with wavelength in the red peak suggests that it is not due to bound-to-bound transitions. GRA

N76-19997# Arkansas Univ., Fayetteville. Dept. of Electrical Engineering.

INFRARED RESPONSE OF IMPURITY DOPED SILICON MOSFET's (IRFET's) Semiannual Technical Report, 1 Feb. - 1 Aug. 1975

Leonard Forbes L. G. Hanscom Field, Mass. AFCRL 1 Aug. 1975 89 p refs

(Contract F19628-75-C-0071; ARPA Order 2794)

(AD-A017604; AFCRL-TR-75-0464; SATR-2) Avail: NTIS CSCL 17/5

Operation and characteristics of the indium doped infrared sensing MOSFET (IRFET) are described. Responsivities of over 40 milliwatts/microjoule have been observed with only small channel width to length ratios and large area devices. Much higher responsivities would be possible with smaller area devices and larger width to length ratios. This device is anticipated to be particularily usefull in the 3 to 5 micrometer wavelength range, and operates at temperatures less than 50K. Preliminary results have been obtained on the operation of the gallium doped infrared sensing MOSFET at 24.5K. A theoretical analysis shows that all surface type semiconductor infrared detectors, CID, CCD, or IRFET have essentially the same maximum attainable signal to noise ratio under shot noise or background limited operation. GRA

N76-19998# Pennsylvania State Univ., University Park. Applied Research Lab.

THEORETICAL CONSIDERATIONS OF TUNNELING THROUGH THIN FILM HETEROJUNCTIONS M.S. Thesis

William C. Liepold 3 Mar. 1975 201 p refs

(Contract N00017-73-C-1418)

(AD-A016936; TM-75-41) Avail: NTIS CSCL 20/12

An 'atomic' barrier model of a metal-insulator-metal heterojunction is developed. This one-dimensional model consists of a square barrier, containing a number of uniformly spaced 'atomic' wells, between two Bohr-Sommerfeld metals. Within this model, the elastic tunneling transmission coefficient is calculated without approximation for a variety of externally applied electric fields. Several approximation schemes, based on extension of Zener's modified WKB approximation for interband tunneling, are considered. The effect of disorder on the nature of the electronic wavefunction in the insulating barrier is examined within the 'atomic' barrier model. A method of characterizing the nature of the electronic states near the 'band' edges of a thin topologically disordered insulating region is developed and interpreted in terms of theoretical notions which apply strictly only to bulk samples. GRA

N76-19999# California Inst. of Tech., Pasadena. Div. of Physics Mathematics and Astronomy.

RESEARCH ON QUANTUM-SUPERCONDUCTIVITY Final Report, 1 Jan. 1969 - 31 Mar. 1975

James E. Mercereau Aug. 1975 11 p refs

(Contract N00014-67-A-0094-0013)

(AD-A017398) Avail: NTIS CSCL 20/12

This report highlights the major accomplishments in superconductivity research at Caltech during the establishment of a new laboratory for this purpose. Topics discussed include thin film formation, devices, and Josephson junctions. GRA

N76-20000# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.

CHEMICAL VAPOR DEPOSITION OF CHALCOGENIDE SEMICONDUCTORS Final Technical Report, 1 Jul. 1973 - 31 Dec. 1974

H. Kent Bowen and J. VanDerSande Aug. 1975 113 p refs

(Contract F33615-73-C-5166; AF Proj. 2421)

(AD-A017524; AFML-TR-75-91) Avail: NTIS CSCL 20/2

Polycrystalline CdTe was prepared by vapor deposition. The elements were vaporized and carried to the reaction chamber using He + 8% H2 as the carrier gas (all at 1 atm total pressure). Deposition rates were 0.1-0.01 mm/hr at temperatures between 725-785C. Columnar grains and micron size pores were found in all samples. Electrical property measurements and x-ray texture studies were made. Transmission electron microscopy elucidated the nature of precitates and voids (50-100 A) in the as grown material and material from other sources. Scattering theory calculations indicate orders of magnitude agreement with the observed absorption coefficients at 10.6 micrometers. A new absorption measuring technique was developed capable of determining beta accurately on small samples. The thermal shift in the fundamental absorption edge due to infrared absorption (10.6 micrometers) was used. Both the theory and measurement system were defined. GRA

N76-20001# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

APPLICATION OF PRINCIPAL COMPONENTS ANALYSIS TO THE STUDY OF SILICATE CRYSTAL STRUCTURES Environmental Research Papers

Rossman F. Giese, Jr. and C. M. Dentan 14 Jul. 1975 57 p refs

(AF Proj. 8607)

(AD-A017043; AFCRL-TR-75-0372; AFCRL-ERP-521) Avail: NTIS CSCL 20/2

Principal components analysis (PCA) is a quasi-statistical technique for transforming a given set of variables or observations into a new set of linearly transformed variables. The new set has the advantage that most of the variance of the original observations can be accounted for with fewer variables, thus simplifying interpretation of the variance. PCA has been applied to (1) micas using only interatomic distances and (2) clinopyroxenes using both interatomic distances and angles. In all cases,

at most three new variables were necessary to account for 90 percent or more of the original total variance. Each of these new variables can be interpreted in terms of distortions of the crystal structures of the two groups of minerals. One of the advantages of PCA is the quantitative evaluation of specific crystal structure distortions. GRA

N76-20002# Naval Surface Weapons Center, White Oak, Md.
VAPOR GROWTH OF Pb(1-x)Sn(x)Te AND Pb(1-x)Sn-(X)Se CRYSTALS Final Report
J. Lowney, R. Bis, and J. Dixon Aug. 1975 42 p refs
(AD-A017316; NSWC/WOL/TR-75-120) Avail: NTIS CSCL 20/2

Bulk crystals of Pb(1-x)Sn(x)Te and Pb(1-x)Sn(x)Se were grown by a simple closed tube vapor transport technique. They were both of high crystalline quality and high electrical mobility. GRA

N76-20003# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CRYSTAL STRUCTURES OF IDEAL, ORDERED TWO-LAYER MICAS Environmental Research Papers
Rossman F. Giese, Jr. 5 Sep. 1975 211 p refs
(AF Proj. 8607)
(AD-A017044; AFCRL-TR-75-0471; AFCRL-ERP-533) Avail: NTIS CSCL 20/2

In minerals exhibiting cation disorder, the variation in crystal structure environments can be studied by constructing model structures for all possible cation distributions. The model structures are constructed using known interatomic distances with the computer algorithm DLS (distance least squares). For two-layer mica polytypes, the number of possible ways of distributing Si and Al over the 16 tetrahedral sites is large: 1820 for Si/Al = 3 (as in muscovite) and 12,870 for Si/Al = 1 (as in margarite). It is not feasible to compute DLS structures for all these models, so both populations have been sampled on a random basis to provide 100 cases each for muscovite 2 M sub 1 and margarite 2 M sub 1. GRA

N76-20004# Naval Undersea Center, San Diego, Calif.
DIFFRACTION INTEGRALS FOR PIEZOELECTRIC SURFACE WAVES: CONSTRUCTION AND DISCUSSION THEREOF Research Report, Jan. - Apr. 1975
D. H. Hageman Oct. 1975 22 p refs
(AD-A017625; NUC-TP-484) Avail: NTIS CSCL 20/1

Diffraction integrals for the elastic-electric waves that propagate along the piezoelectric surface are constructed from elementary solutions of the wave equations. These integrals involve depth-dependent angular spectra which are calculable from aperture functions in the usual way. Upon setting the depth coordinate equal to zero, they go over into specialized versions that have been put forward elsewhere. The usefulness of these integrals relative to surface acoustic wave devices depends upon how well aperture functions can be approximated, and upon the adequacy of considering only the wave components at the surface. At present, there is no clear answer to either question. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-20005 Washington Univ., Seattle.
KINETIC THEORY OF PHASE SEPARATION IN BINARY LIQUID MIXTURE Ph.D. Thesis
Chung Yuan Mou 1975 87 p
Avail: Univ. Microfilms Order No. 76-4772

A dynamic theory for the spontaneous formation and growth of spherical drops in a metastable liquid phase is developed. Hydrodynamics, nonequilibrium thermodynamics, and thermodynamic fluctuation theory are used to predict the nucleation kinetics for phase separation in a liquid binary mixture. Nucleation rate expressions are derived for various conditions. The nucleation rates are considerably lower than those predicted by the classical nucleation theory and the inhomogeneities which result from forming nuclei in a finite time cause the actual kinetic path to differ considerably from the classical path. A qualitative agreement with experiment is demonstrated. Dissert. Abstr.

N76-20006# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF COMBUSTION PRODUCTS. VOLUME 3: OXYGEN AND AIR-BASED PROPELLANTS
V. E. Alemasov, A. F. Dregalin, A. P. Tishin, V. A. Kmudyakov, V. N. Kostin, and V. P. Glusmko, ed. 1975 633 p refs
Transl. into ENGLISH of the book "Termodinamicheskie i Teplofizicheskie Svoistva Produktov Sgoraniya. 3: Topliva na Osnove Kisloroda i Vozdukha" Moscow, Izd. Vses. Inst. Nauchn. i Tekhn. Inform., 1971 Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50007-Vol-3; ISBN-0-7065-2538-2) Avail: NTIS HC $16.25

Information on the thermodynamic and thermophysical properties of the combustion products of eleven propellants, in which oxygen or air (including oxygen-enriched air) is used as the oxidizer is given. All the data reported were obtained by computation. The combustion products discussed contain substances in the condensed state, and are complex heterogeneous systems. In many cases, in the calculation of their properties difficulties arose, mainly because of the limitations imposed by the Gibbs phase rule. Methods for calculating complex heterogeneous equilibria were also presented. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-20007*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
MEANS FOR OPTIMUM ACCOMODATION OF THE DAILY HOSPITAL ROUTINE TO THE LIFE STYLE OF THE PATIENTS
Berlinde Grebien Washington NASA Feb. 1976 15 p refs
Transl. into ENGLISH from Oesterr. Krankenpflege Zeitung (Austria), v. 27, no. 9, Sep. p 231-238
(Contract NASw-2789)
(NASA-TT-F-16884) Avail: NTIS HC $3.50 CSCL 05A

The hospital in its contemporary state presents great challenges to the personnel and patients. Only true team-work of all professional groups involved directly or indirectly with the patient, and dedicated personnel will improve the operation. The administration of each hospital must create an optimum daily routine for the patient. Author

N76-20008# California Univ., Los Angeles. School of Engineering and Applied Science.
GROUP DECISION ANALYSIS Interim Report
N. C. Dalkey Aug. 1975 46 p refs
(Contract N00014-69-A-0200-4056; ARPA Order 2841)
(AD-A016273; UCLA-ENG-7571) Avail: NTIS CSCL 05/10

Delphi, as a procedure for aggregating judgments under certainty, has suffered from the lack of an underlying theoretical framework, especially one that relates group estimates to decision processes. It is shown that consistent group preference functions can be formulated by the use of anchored scales, i.e., individual

preference scales with fixed reference objects. A justification for the use of group probability judgments can be made, based on a family of theorems to the effect that the accuracy of a group judgment is always greater than (or at worst equal to) the average accuracy of the individual judgments. GRA

N76-20009# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF NON-BEHAVIORAL FACTORS AFFECTING WORK ORDER TIME AND COST PRODUCTIVITY M.S. Thesis
Joseph H. Cox, Jr. and Joseph B. Lewis, Jr. Aug. 1975 104 p refs
(AD-A016032; SLSR-18-75B) Avail: NTIS CSCL 05/3

The improvement of productivity of the civil engineering work force has long been a goal of Air Force Civil Engineering managers. Each year the requirement to do more work with less resources has become more and more pronounced. The first step in any increase is the identification of those factors with a direct bearing on productivity. The authors of this thesis have taken actual work order and shop data from a U.S. Air Force base and developed linear mathematical models using multiple linear regression analysis to identify those non-behavioral factors with a direct or inverse relationship to productivity. After testing the models for statistical significance, the authors conclude that a linear relationship exists between certain work order and shop parameters and the amount of time and cost productivity for a given shop. GRA

N76-20010# National Science Foundation, Washington, D.C. Office of Intergovernmental Science and Research Utilization.
REPORT OF THE OMB STUDY COMMITTEE ON POLICY MANAGEMENT ASSISTANCE. VOLUME 3: BACKGROUND PAPERS AND RESEARCH MATERIALS
Robert A. Shapek Jun. 1975 1168 p refs
(PB-243804/2; NSF/RA/G-75-010-Vol-3) Avail: NTIS HC $17.25; MF $2.75 (special price) CSCL 05A

An interagency study committee on policy management assistance, comprised of career executives from the primary Federal agencies with an interest in Federal technical assistance to state and local governments was asked to assess current Federal technical assistance efforts and then to develop Federal strategies and options for strengthening state and local policy management capabilities. The Federal technical assistance effort was surveyed and agencies made presentations to the Committee. Non-Federal perspectives were acquired through a series of specially-commissioned studies -- including literature reviews, issue papers, and position papers. A compilation of those studies, as well as committee and staff working papers, and an extensive bibliography are reported. GRA

N76-20011# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF THE PROGRAM MANAGEMENT RESPONSIBILITY TRANSFER PROCESS FOR THE F-16 M.S. Thesis
John D. Rominger Sep. 1975 104 p refs
(AD-A017639; GSM/SM/75S-8) Avail: NTIS CSCL 05/1

This report analyzes the Program Management Responsibility Transfer (PMRT) Process for several major aircraft weapons systems for the purpose of applying lessons learned to the F-16 PMRT process. The report looks at the problems encountered on previous switchover systems and recommends solutions or methods by which the F-16 can avoid the same problems. The primary data sources for this report were personal interviews of key program management personnel and official Air Force guidance in the form of regulations. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-20012# Environmental Protection Agency, Seattle, Wash.
CATEGORICAL PROGRAMS DIVISION: SUMMARIES OF ENVIRONMENTAL INFORMATION SOURCES AND SERVICES
Willis Tate Mar. 1973 25 p
(PB-245798/4; Working-Paper-89) Avail: NTIS HC$3.50 CSCL 05B

A compilation of information centers of computerized data bases and documents accessible to Region X on the following programs: pesticides, radiation, solid waste and noise abatement and control is presented. Most of the information services described are now available for usage. There are others still in a developmental stage and are expected to be operational within a few months. In scope, this report is provided as an additional resource for management effectiveness in program control. GRA

N76-20013# Defense Logistics Studies Information Exchange, Fort Lee, Va.
DLSIE: DESCRIPTOR LIST
Oct. 1975 84 p
(AD-A017401) Avail: NTIS CSCL 05/2

The publication has been developed as part of the Defense Logistics Studies Information Exchange (DLSIE) continuing effort to provide its users with products that will assist in identifying logistics research relevant to their needs. The DLSIE Descriptor List provides an alphabetical listing of descriptor terms that are used by DLSIE analysts in describing planned, in-process, and completed logistics research efforts which are added to the DLSIE data base. After each entry a parenthetical number is shown. The number represents the total number of citations in the data base for each descriptor as of 31 July 1975. Definitions are provided for acronyms or words that one may not be familiar with. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-20014# Stanford Univ., Calif. Dept. of Economics.
AN ASSESSMENT OF APPROACHES TO THE STUDY OF FACTORS AFFECTING ECONOMIC PAYOFFS FROM TECHNOLOGICAL INNOVATION, A STATE-OF-THE ART STUDY. VOLUME 1: ANALYTIC REPORT AND SUMMARY Final Report
Nathan Rosenberg Mar. 1975 231 p refs
(Grant NSF RDA-39707)
(PB-245905/5; NSF/RDA-73/11/1) Avail: NTIS HC $8.00 CSCL 05C

An economic approach to the study of technological change is evaluated in terms of: (1) the available knowledge of the history of technological change and innovation; and (2) the few empirical studies that exist of the economic contributions of technology which do justice to the complexities of the subject. One conclusion is that the prevalent conceptualization of technological change and innovation in economics has tended to confine analysis of innovation to characteristics likely to be true only of major innovations. Much of technological change, however, which produces important economic benefits, consists of the cumulation of minor improvements. GRA

N76-20015# Stanford Univ., Calif. Dept. of Economics.
AN ASSESSMENT OF APPROACHES TO THE STUDY OF FACTORS AFFECTING ECONOMIC PAYOFFS FROM TECHNOLOGICAL INNOVATION, A STATE-OF-THE-ART STUDY. VOLUME 2: ABSTRACTS
Nathan Rosenberg, James Clifton, and Wayne Lewis Mar. 1975 111 p
(Grant NSF RDA-39707)
(PB-246434/5; NSF/RDA-73/11/2) Avail: NTIS HC $5.50 CSCL 05C

The aims of the project were to critically evaluate the prevalent economics approach to the study of technological change, and to identify the major gaps in our knowledge of the factors that

affect the private and social payoffs from innovation. A set of abstracts which contains selected summaries of a large body of diverse literature is presented for the following: (1) theoretical economic analyses of innovation, including critiques of some conventional theoretical assumptions; (2) historical investigations and case studies of inventions and innovations; (3) econometric analyses of firm and industry R and D. GRA

N76-20016# Stanford Univ., Calif.
A NOTE ON THE OBJECTIVE JUNCTION FOR THE PILOT MODEL Optimization Lab.
George B. Dantzig Aug. 1975 11 p refs
(Contracts N00014-75-C-0865; N00014-75-C-0267; NR Proj. 047-143; NR Proj. 047-064)
(AD-A016217; SOL-75-20) Avail: NTIS CSCL 05/3

It is shown that if the objective for a linear programming model is chosen to be the weighted sum of people at different consumption levels, where the weights are equal to consumption levels measured in base-year prices, then the prices of the physical flow model will be comparable to base year prices in that people given the same income less taxes and savings will be able to purchase the same bill of goods; moreover prices will remain invariant if they use their demand functions to buy a different bill of goods. It is also shown that if industries use their respective production to change their inputs to maximize production, this will also increase the objective gross national consumption. GRA

N76-20017# Stanford Univ., Calif. Optimization Lab.
ON A PILOT LINEAR PROGRAMMING MODEL FOR ASSESSING PHYSICAL IMPACT ON THE ECONOMY OF A CHANGING ENERGY PICTURE
George B. Dantzig and S. C. Parikh Aug. 1975 19 p refs
(Contracts N00014-75-C-0865; N00014-75-C-0267; NR NR Proj. 047-143; NR Proj. 047-064)
(AD-A016187; SOL-75-14R) Avail: NTIS CSCL 05/3

This paper deals with a dynamic linear programming model on a pilot scale that attempts to describe in physical terms many of the technological interactions within and across the sections of the American Economy, including a detailed energy sector. The general aim of the model is to provide information on what the country would achieve over the long run in physical terms in the face of a changing energy picture. The model is expected to (1) incorporate most recent available data of sufficiently good quality (albeit in an aggregated form) that it can be used to generate some meaningful scenarios showing how the economy might be affected if the energy picture evolves in a specific way, and (2) provide us at the Systems Optimization Laboratory a prototype for research in solving large-scale linear programming models of energy systems. GRA

N76-20018# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN APPRAISAL OF THE SHORT-TERM COST RESULTS OF A SELECTED NUMBER OF AIR FORCE SHOULD COST STUDIES M.S. Thesis
William E. Schaefer and Roy F. Birkhead Aug. 1975 97 p refs
(AD-A016262; SLSR-2-75B) Avail: NTIS CSCL 15/5

Should Cost briefly can be described as a technique of contract pricing which seeks to determine a realistic price objective which reflects reasonably achievable economies and efficiencies of contractor operations. The Air Force has performed a number of Should Cost studies, each with the stated objective of achieving the desired results contemplated by the above definition. Has the Air Force achieved these results. Up to this point, this question has not been easily answerable since the final cost outcomes have not been available as a basis against which originally negotiated cost targets could be compared. Based upon a limited sample of four contracts which were negotiated using the Should Cost technique, the study showed that Should Cost, as used by the Air Force, may be producing results which are not more effective than those experienced from contracts negotiated using conventional cost analysis. GRA

N76-20019# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
COST/SCHEDULE CONTROL SYSTEM CRITERIA: AN ANALYSIS OF MANAGERIAL UTILITY Final Report
Marion A. Ostdiek and Richard T. Estes Aug. 1975 132 p refs
(AD-A016270; SLSR-15-75B) Avail: NTIS CSCL 15/5

The Cost/Schedule Control System Criteria (C/SCSC) is imposed on a contractor's management information system during the performance of a contract for a major weapon system. Previous studies on C/SCSC had identified managerial resistance to the criteria. Data, gathered through structured interviews with military and contractor managers, were analyzed to find if a predetermined set of attitudes affected the perceived utility of C/SCSC. The selected variables of acceptance of quantitative techniques, cost consciousness, knowledge of quantitative techniques, and hierarchical position were studied as major factors influencing the perceived utility of the criteria. Relationships between the selected variables were not supportive of all five stated hypotheses; however, the study provided detailed data on the selected variables and on C/SCSC as a management tool. After a review of the managers' opinions and the available data, a conclusion was reached showing that the criteria in their present form are not sufficiently productive for the project goals. The study also indicates that a significant difference exists between military and civilian managers. The contractor manager exhibited a high correlation between perceived utility and each of four variables while the military manager shows this relationship between perceived utility and only one of the four variables. GRA

N76-20020# Bureau of Mines, Washington, D.C.
BASIC ESTIMATED CAPITAL INVESTMENT AND OPERATING COSTS FOR UNDERGROUND BITUMINOUS COAL MINES. MINES WITH ANNUAL PRODUCTION OF 1.06 TO 4.99 MILLION TONS FROM A 72-INCH COALBED.
Sidney Katell and L. H. Berkshire Jul. 1975 47 p Revised
(PB-245918/8; BM-IC-8682-Rev; BM-IC-8632) Avail: NTIS HC $4.00 CSCL 08I

Basic estimated capital investment, operating costs, and selling prices are presented for four underground bituminous mines producing coal with annual production ranging from 1.06 to 4.99 million tons. Mines have a 20-year life. wages and union welfare payments are considered as of December 1974, and costs for material and equipment are based on 1975 indexes. Revision of Information Circular 8632-updates costs and wages. GRA

N76-20021# Skelly and Loy, Harrisburg, Pa.
ECONOMIC ENGINEERING ANALYSIS OF US SURFACE COAL MINES AND EFFECTIVE LAND RECLAMATION Open File Report, 24 Jun. 1974 - 24 Mar. 1975
24 Mar. 1975 611 p refs
(Contract DI-MESA-SO241049)
(PB-245315/7; BM-OFR-74-75) Avail: NTIS HC $16.25 CSCL 08I

This report covers technology of surface coal mining in the United States, including current problems, possible solutions, and projected future developments. It presents a coordinated, systematized, technical, economic analysis of the industry, describing practices and trends and giving cost data. To evaluate the mining techniques employed, the United States was divided into four regions where similar geologic and topographic conditions warrant similar mining practices. Mining methods for each region were examined in detail from a unit operation viewpoint. Economics of alternative mining equipment choices are discussed. The report covers surface coal mining from exploration through transportation to markets. GRA

N76-20022# California Univ., Berkeley. Operations Research Center.
OPTIMAL SYSTEM ALLOCATIONS WITH PENALTY COSTS
Cyrus Derman, Gerald J. Lieberman, and Sheldon M. Ross Sep. 1975 19 p refs
(Contract N00014-75-C-0781; Grant DAHC04-75-G-0163)
(AD-A017238; ORC-75-15) Avail: NTIS CSCL 12/2

There are N stages to sequentially construct I successful components. At each stage, one allocates a certain amount of money for the construction of a component. If y is the amount allocated, then the component constructed will be a success with probability P(y), where P is a continuous nondecreasing

function satisfying P(0) = 0. After each component is constructed, one is informed as to whether or not it is successful. If, at the end of the N stages, there are i components short, then a final penalty cost C(i) is incurred. The problem is to, at each stage, determine how much money to allocate so as to minimize the total expected cost (construction cost plus penalty cost) incurred. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-20023# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Teague Washington GPO 15 Mar. 1976 185 p Rept. to accompany H.R. 12453 by Comm. on Sci. and Technol., 94th Congr., 2d Sess., 15 Mar. 1976
(H-Rept-94-897) Avail: US Capitol, House Document Room
Details regarding H.R. 12454, which authorizes appropriations to NASA for fiscal year 1977, are presented. D.M.L.

N76-20024# Committee of the Whole House on the State of the Union (U. S. House).
TO AUTHORIZE APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR RESEARCH AND DEVELOPMENT, CONSTRUCTION OF FACILITIES, AND RESEARCH AND PROGRAM MANAGEMENT AND FOR OTHER PURPOSES
Washington GPO 1976 14 p H.R. 12453 referred to the Comm. of the Whole House on the State of the Union, 94th Congr., 2d Sess., 15 Mar. 1976
(H-Rept-94-897) Avail: US Capitol, House Document Room
The text of H.R. 12453, the National Aeronautics and Space Adminstration Authorization Act, 1977, is presented. The bill authorizes appropriations to NASA for research and development, construction of facilities, research and program management, and other purposes. D.M.L.

N76-20025# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977, PART 1
Washington GPO 1976 832 p Hearings on S. 2864 before Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 1976
(GPO-65-431) Avail: Comm. on Aeron. and Space Sci.
Budget detail submitted by the National Aeronautics and Space Administration for FY 1977 is presented. Emphasis is placed on research and development programs, construction of facilities, and research and program management. J.M.S.

N76-20026# Committee on International Relations (U.S. House).
SCIENCE, TECHNOLOGY, AND AMERICAN DIPLOMACY. SCIENCE AND TECHNOLOGY IN THE DEPARTMENT OF STATE (BRINGING TECHNICAL CONTENT INTO DIPLOMATIC POLICY AND OPERATIONS
Washington GPO Jun. 1975 188 p refs Presented to Subcomm. on Intern. Security and Sci. Affairs of Comm. on Intern. Relations, Jun. 1975 Prepared by the Library of Congress, Sci. Policy Res. Div.
(GPO-51-650) Avail: SOD HC $1.90
The impact of science and technology on the functions and organizations of the Department of State was analyzed, and department efforts and opportunities for constructively relating science and technology to its missions were described. Author

N76-20027# Committee on Science and Technology (U. S. House).
ERDA AUTHORIZATION, PART 5, 1976 AND TRANSITION PERIOD
Washington GPO 1975 798 p refs Hearing before Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess. No. 4, 25, 27-28 Feb. 1975
(GPO-50-274) Avail: Subcomm. on Energy Res. Development and Demonstration
The hearings concerning the ERDA budget request for fiscal year 1976 are reported. The role of colleges and universities in research for solar, geothermal, and systems for conservation of energy are discussed. It is recommended that ERDA organize two programs: a research and technology grant program, and university centers to build a knowledge network of energy technology. The energy demand and supply outlook for 1985, energy sources, areas of special concern, and electric utilities are considered. F.O.S.

N76-20028# Committee on Aeronautical and Space Sciences (U. S. Senate).
TO AUTHORIZE APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR RESEARCH AND DEVELOPMENT, CONSTRUCTION OF FACILITIES, AND RESEARCH AND PROGRAM MANAGEMENT, AND FOR OTHER PURPOSES
Washington GPO 1976 25 p Act H.R. 12453 referred to Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 30 Mar. 1976
(S-Rept-94-718) Avail: US Capitol, Senate Document Room
The National Aeronautics and Space Administration Authorization Act, 1976, which appropriates money to NASA for research and development, facility construction, research and program management, and various other operating expense is presented. Author

N76-20029# Joint Committe on Atomic Energy (U. S. Congress).
ATOMIC ENERGY LEGISLATION THROUGH 93RD CONGRESS, 2ND SESSION
Washington GPO Jul. 1975 502 p refs Prepared by Joint Comm. on Atomic Energy, 94th Congr., 1st Sess., Jul. 1975
(GPO-49-939) Avail: SOD HC $4.25
Statues and material pertaining to atomic energy legislation are presented. Topics considered are: the Atomic Energy Act of 1954; The Energy Reorganization Act of 1974; the AEC Authorization Acts; International Atomic Energy Agency Participation Act of 1957; Atomic Energy Community Act 1955. Appropriations, legislative history of various acts, and documents relating to the activation of the Energy Research and Development Administration and Nuclear Regulatory Commission are included. J.M.S.

N76-20030# Committee on Science and Technology (U. S. House).
ERDA AUTHORIZATION, 1976 AND TRANSITION PERIOD OVERVIEW
Washington GPO 1975 560 p refs Hearing before Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 9, 6 Feb. 1975
(GPO-49-191) Avail: Comm. on Sci. and Technol.
The following subjects were discussed: (1) Public Law 93-438, the Energy Reorganization Act of 1974, (2) Examination of the budget of the Energy Research and Development Administration for fiscal year 1976, including a treatment and breakdown of the various research and development projects. Y.J.A.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-20031*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF METHODS OF REDUCING COMMUNITY NOISE IMPACT AROUND SAN JOSE MUNICIPAL AIRPORT

Jan M. Glick (Stanford Univ., Calif.), Richard S. Shevell (Stanford Univ., Calif.), and Jeff V. Bowles Nov. 1975 61 p refs
(NASA-TM-X-62503; A-6346) Avail: NTIS HC $4.50 CSCL 13B

A computer simulation of San Jose Municipal Airport was made of the airport noise impact on the surrounding communities. Alternate operational procedures, improved technology, and land use conversion were evaluated as methods of reducing noise impact in the airport application to other airport communities similar to San Jose. Two segment approaches and thrust cutbacks on takeoff were found to be very helpful in reducing community noise impact; however, these procedures cannot reduce the noise very near the airport. The introduction of sound absorption material (SAM) was found to reduce noise annoyance by over 25%, and the introduction of refan by over 60%. Replacing the present aircraft by DC-10's was found to reduce the noise problem to very small proportions, and the introduction of an advanced technology twin was found to essentially eliminate the noise problem. Author

N76-20032*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA TECH BRIEFS, 1974
Feb. 1975 75 p refs
(NASA-SP-5021(15)) Avail: NTIS HC $3.00 CSCL 05B

The following information was given for 1974: (1) abstracts of reports dealing with new technology derived from the research and development activities of NASA or the U.S. Atomic Energy Commission, arranged by subjects: electronics/electrical, electronics/electrical systems, physical sciences, materials/chemistry, life sciences, mechanics, machines, equipment and tools, fabrication technology, and computer programs, (2) indexes for the above documents: subject, personal author, originating center. Y.J.A.

N76-20033*# Mathematica, Inc., Princeton, N.J.
QUANTIFYING THE BENEFITS TO THE NATIONAL ECONOMY FROM SECONDARY APPLICATIONS OF NASA TECHNOLOGY, EXECUTIVE SUMMARY
Mar. 1976 12 p
(Contract NASw-2734)
(NASA-CR-2674) Avail: NTIS HC $3.50 CSCL 05A

The feasibility of systematically quantifying the economic benefits of secondary applications of NASA related R and D was investigated. Based upon the tools of economic theory and econometric analysis, a set of empirical methods was developed and selected applications were made to demonstrate their workability. Analyses of the technological developments related to integrated circuits, cryogenic insulation, gas turbines, and computer programs for structural analysis indicated substantial secondary benefits accruing from NASA's R and D in these areas. Author

N76-19198* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Design Section
AUTOMATED PARKING GARAGE SYSTEM MODEL
Earl R. Collins, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 387-394 (For availability see N76-19172 10-12)
(Contract NAS7-100)
CSCL 13B

88 SPACE SCIENCES (GENERAL)

N76-20034# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT, OCTOBER-DECEMBER 1974
Dec. 1974 16 p
Avail: NTIS HC $3.50

Greenwich time and latitude observations for October through December 1974 are presented. Radio time signals and standard frequency emissions are included. ESA

N76-19111* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE SCIENCE: SOME SELECTED PROBLEMS AND ACCOMPLISHMENTS
Robert T. Jones *In its* Collected Works of Robert T. Jones Feb. 1976 p 903-916 (For availability see N76-19059 10-02)
CSCL 22A

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-20035 California Inst. of Tech., Pasadena.
BINARY GALAXIES AND GROUPS OF GALAXIES Ph.D. Thesis
Edwin Lewis Turner 1976 204 p
Avail: Univ. Microfilms Order No. 76-6543

Using precisely defined identification criteria, a sample of 156 binary galaxy systems was selected. Data on their magnitudes, morphological types, radial velocities, angular separations, et cetera, are presented. Accurate, new radial velocities for both components of 66 of the pairs were measured. With particular attention to the removal of selection effects, extensive statistical and dynamical analyses of these data were made. A catalog of small groups of galaxies was generated by identifying regions of the sky in which the surface number-density of galaxies is enhanced. A variety of data on the groups, their component galaxies, and those galaxies not assigned to groups (i.e., field galaxies) is presented. The generally small velocity dispersions of the groups validate the group identification algorithm. Using the available data, statistical analyses of the galaxy luminosity function in groups, the group dynamics, and the multiplicity function are described. Dissert. Abstr.

N76-20036 California Inst. of Tech., Pasadena.
STELLAR POPULATIONS AND VELOCITY DISPERSIONS OF TEN NEARBY GALAXIES Ph.D. Thesis
Theodore Burton Williams 1976 116 p
Avail: Univ. Microfilms Order No. 76-6547

Spectra from 3800 A to 6800 A with resolution of 2 A were obtained for 137 stars, 5 globular clusters, and the nuclear regions of 10 galaxies. Line indices measured for 74 absorption lines and bands are presented. A method for determining parametrized stellar population models is discussed, and population models and error estimates are derived for the ten galaxies. Most of the models have significant contributions from M giant stars and from metal poor stars. Only two of the galaxies seem to contain stars with metal lines stronger than those of stars in the solar neighborhood. Three of the ellipticals show evidence of recent star formation. The galaxies can be divided by morphological type into three distinct population groups: E0, Sa, Sb, and Sc. Velocity dispersions were derived for the nuclear regions of the galaxies, mass to light ratios were then derived from the velocity dispersions. Dissert. Abstr.

N76-20037 California Inst. of Tech., Pasadena.
THE STELLAR CONTENT OF THE NUCLEAR REGIONS OF Sc GALAXIES Ph.D. Thesis
Barry Edmund Turnrose 1976 186 p
Avail: Univ. Microfilms Order No. 76-6544

The stellar content of the nuclear regions of seven nearby Sc galaxies was determined by means of population syntheses utilizing narrow-band spectrophotometric observations covering the wavelength range 3300A-10400A. A linear-programming fitting technique was used in conjunction with simple models of star formation to provide physically consistent population models incorporating multiple generations of stars. Evidence is found for substantial intrinsic reddening in the nuclear regions studied. Upper main-sequence stars are significant contributors in most cases, and the lower main sequence contributes insignificantly in all cases. All available indicators are consistent with M-giant-star dominance at the longest wavelengths. Absolute measurements of the emission-line spectra of the nuclear regions are presented and discussed. Dissert. Abstr.

N76-20038 California Inst. of Tech., Pasadena.
SOFT X-RAY EMISSION FROM THE VELA SUPERNOVA

REMNANT Ph.D. Thesis
William Edwin Moore 1976 109 p
Avail: Univ. Microfilms Order No. 76-6537

Soft X-ray observation of the Vela Supernova Remnant is described. X-ray surface brightness maps of the Remnant are presented which show a vague shell structure with two prominent emission regions and a third of somewhat less intensity. A new method for producing these maps is described. Spectral results are presented for the entire nebula and for the two prominent subregions. The spectra are found to be represented by the model of X-ray emission from a low density, high temperature plasma. Line emission, radiative recombination, and thermal bremsstrahlung are included. Narrow band measurements with a filter system reveal that the emission from O VIII is deficient by at least a factor of three. A search for X-ray pulsations from the Vela pulsar is described, and upper limits are given for X-ray pulsations at the period observed for the radio pulsar.
Dissert. Abstr.

N76-20039*# California Univ., Los Angeles. Dept. of Astronomy.
INVESTIGATION THE SHELL STARS OMICRON AND THETA PER, AND OF THE ECLIPSING BINARY BETA LYR Final Technical Report, 1 May 1974 - 31 Dec. 1975
Miroslav Plavec 31 Dec. 1975 19 p refs
(Grant NGR-05-007-489)
(NASA-CR-146432) Avail: NTIS HC $3.50 CSCL 03A

All three stars showed rather complicated spectra, which require a very detailed spectroscopic analysis. The far UV spectrum of Beta Lyrae is clearly peculiar, with a multitude of emission lines not observed on any other star so far scanned with Copernicus. This made this star at once the most interesting and also, in a sense, easier to study. The other two stars display a spectrum rich in absorption lines, some of them being fairly broad (as expected for photospheric lines of rapidly rotating objects), some sharp. The later were clearly non-photospheric lines. An attempt was made to distinguish the circumstellar from the interstellar components. Author

N76-20040*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
HIGH SPATIAL RESOLUTION MULTI-COLOR OBSERVATIONS OF NEPTUNE DURING OCCULTATION BY THE MOON Semiannual Status Report, 30 Sep. 1975 - 31 Mar. 1976
Joseph Veverka 25 Mar. 1976 28 p refs
(Grant NsG-7126)
(NASA-CR-146505; CRSR-631) Avail: NTIS HC $4.00 CSCL 03A

Preparations for the observation of Mars occultation using the 36 inch telescope on a C-141 airborne observatory were described, including technical improvements made to existing equipment. The abstracts of the following four publications supported by the grant were presented: (1) atmosphere composition from refractivity measurements made during occultations, (2) how big is Iapetus?, (3) the diameter of Titan, (4) design and operating characteristics of voltage to frequency converters suited for occultation work. The planned observation of the April 8, 1976 occultation of the epsilon Gem star from the C-141 airborne observatory was described. Y.J.A.

N76-20041*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A DECAMETRIC WAVELENGTH RADIO TELESCOPE FOR INTERPLANETARY SCINTILLATION OBSERVATIONS Final Project Report
Willard M. Cronyn (NOAA, Boulder, Colo.) and Stanley D. Shawhan Jul. 1975 109 p refs
(Grant NGL-16-001-002; NASA Order S-57016-A; Grant NSF DES-73-06559)
(NASA-CR-146350; NOAA-75092303; COM-75-11458/7; U-of-Iowa-75-12-Rev) Avail: NTIS HC $5.50 CSCL 03B

A phased array, electrically steerable radio telescope, with a total collecting area of 18 acres has been constructed for the purpose of remotely sensing electron density irregularity structure in the solar wind. The radio telescope will locate, map and track large scale features of the solar wind, such as streams and blast waves, by monitoring a large grid of natural radio sources subject to rapid intensity fluctuation (interplanetary scintillation) caused by the irregularity structure. This report is an account of progress to date on construction and operation of the telescope, observations, and initial scientific results. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-20042*# Agence Tunisienne de Public-Relations, Tunis.
WATER IN THE UNIVERSE
V. F. Derpgoltz Washington NASA Mar. 1976 297 p refs Transl. into ENGLISH of the book "Voda vo Vselennoy" Leningrad, Nedra Press, 1971 224 p Sponsored by NASA
(Contract NSF C-504)
(NASA-TT-F-16967; TT-73-55113) Avail: NTIS HC $9.25 CSCL 03B

The nature of the distribution of various compounds of hydrogen and oxygen found in outer space and on bodies of the solar system is described. Emphasis is placed on the water of earth which is analyzed from various viewpoints. It is both very common and of absolute necessity, is insufficiently studied and the cause of huge disasters. Natural water, and its physico-chemical properties, quantitave evolution, dynamics, energetics, origin and formation are considered. Author

N76-20043*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ACCELERATION OF ENERGETIC PARTICLES IN THE INTERPLANETARY MEDIUM BY TRANSIT-TIME DAMPING
L. A. Fisk Jan. 1976 35 p refs Submitted for publication
(NASA-TM-X-71078; X-660-76-26) Avail: NTIS HC $4.00 CSCL 03B

Transit time damping is examined as a possible means for accelerating low energy particles in co-rotating streams and interstellar ions. Data show that: the protons in co-rotating streams may be accelerated by transient-time damping the small-scale variations in the field magnitude that are observed at a low level in the inner solar system. The interstellar ions may be accelerated by transit time damping large-scale field variations in the outer solar system. Author

N76-20044*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ACCELERATION OF ENERGETIC PARTICLES IN THE INTERPLANETARY MEDIUM
L. A. Fisk Jan. 1976 27 p refs Submitted for publication
(NASA-TM-X-71077; X-660-76-25) Avail: NTIS HC $4.00 CSCL 03B

Fermi scattering and transit time damping are two possible mechanisms for accelerating low energy protons (approximately 1 Mev) in co-rotating particle streams. Solutions to the equations which govern particle behavior in such streams are presented. It was found that acceleration by Fermi scattering requires a scattering mean-free path more than an order of magnitude smaller than the nominal value for low energy particles of 0.1 AU. Transit time damping of only the observed low level of magnitude fluctuations in the interplanetary magnetic field appears to yield the required acceleration rate. Measurements of the direction of the anisotropy in the particle streams could help in deciding which mechanism is operative. In the case of Fermi scattering the anisotropy must be in the heliocentric radial direction, whereas for transit time damping a significant azimuthal anisotropy could be present. Author

N76-20045# Montpellier Univ. (France). Dept. de Mathematiques.
STATISTICAL BOOTSTRAP IN WONDERLAND (COMMENTS ON AN AMUSING COSMOLOGICAL MODEL)
Remi Hakim Jun. 1975 32 p refs Presented at the Marcel Grossmann Meeting, Trieste, Italy, 7-12 Jul. 1975
Avail: NTIS HC $4.00

A cosmological model based on the Hagedorn-Frantschi's statistical model of multiple particle production is discussed. In

this cosmological model galaxies are considered as remnants of supermassive resonances. It is argued that, at the present time no theoretical argument (Schwarzschild radius, etc...) can be used to reject the model and observations are consistent with the model. In spite of these two points the model is not to be taken seriously: it only raises interesting theoretical problems and also emphasizes the poor state of present observational data. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-20046 California Inst. of Tech., Pasadena.
TOPICAL STUDIES OF THE GEOLOGY OF THE THARSIS REGION OF MARS Ph.D. Thesis
Karl Richard Blasius 1976 96 p
Avail: Univ. Microfilms Order No. 76-6522

Mariner 9 images of four great volcanic shields of the Tharsis region of Mars show many circular craters. An attempt was made to date areas covered by high resolution images using only small (< 1 km) diameter craters. Three types of large-scale mass movements - rock-slides, slumps, and a type of mass flowage were tentatively identified in the Mariner 9 photographs of the basal escarpment of the Martian volcano Olympus Mons. The morphology of slide deposits suggests lubrication of their movements by cushions of compressed gas. Many overlapping pictures, potential data for the construction of topographic maps, were obtained by the television cameras on Mariner 9. Topographic maps of several Martian surface features, are presented.
Dissert. Abstr.

N76-20047*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INITIAL BASALT TARGET SITE SELECTION EVALUATION FOR THE MARS PENETRATOR DROP TEST
T. E. Bunch, William L. Quaide, and George Polkowski (LEE Corp., Richmond, Calif.) Mar. 1976 28 p ref
(NASA-TM-X-73111; A-6476) Avail: NTIS HC $4.00 CSCL 03B

Potential basalt target sites for an air drop penetrator test were described and the criteria involved in site selection were discussed. A summary of the background field geology and recommendations for optimum sites are also presented. Author

N76-20048*# Kanner (Leo) Associates, Redwood City, Calif.
MODERN METHODS AND RESULTS OF MAPPING THE MOON AND MARS, 1. PROBLEMS OF MAPPING THE MOON, 2
Yu. S. Tyuflin and I. A. Kutuzov Washington NASA Mar. 1976 17 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 5, 1975 p 66-67, 68-73
(Contract NASw-2790)
(NASA-TT-F-16921) Avail: NTIS HC $3.50 CSCL 03B

Photographic surveys of the lunar surface, ground-based laser ranging and long-base radio interferometry of the moon and gravimetric and magnetic measurement are discussed. The establishment of selenocentric and areocentric coordinate systems and the corresponding network of reference points is also considered. The various types and scales of maps of the moon and Mars are introduced. The achievements of recent years in obtaining data on the moon, including earth-based investigations, studies and photographic surveys from lunar orbit and manned and unmanned expeditions on the surface of the moon are summarized. Author

N76-20049# Israel Program for Scientific Translations, Ltd., Jerusalem.
LUNAR SOIL SCIENCE. PHYSICOMECHANICAL PROPERTIES OF LUNAR SOILS
I. I. Cherkasov, V. V. Shvarev, and A. Yu. Ishlinskii, ed. 1975 175 p refs Transl. into ENGLISH of the book "Nachala Gruntovedeniya Luny. Fiziko-Mekhanicheskie Svoistva Lunnykh Gruntov" Moscow, Nauka Press, 1971
(ISBN-0-7065-1539-0) Avail: NTIS HC $6.75

Current (1975) views of the genesis, structure and properties of lunar soils based on astronomical and radiophysical studies of the moon are presented. Lunar research from orbital spacecraft is discussed, and techniques and equipment employed to investigate lunar soils in soft-landed lunar stations are described in detail. A separate section is devoted to examinations of the first lunar rock samples brought to earth in 1969. Attention is devoted to terrestrial volcanic soils, which are the closest natural analogs of lunar soils, and also to experiments on certain artificial materials simulating lunar soils. Aspects dealt with included the effect of gravity and packing density on the mechanical properties of granular materials, the effect of high vacuum on interaction between individual grains, simulation of the formation of loose lunar deposits, and simulation of the interaction between landing gear components and soils. Author

N76-20050*# Woods Hole Oceanographic Institution, Mass.
GRAVITY AND CRUSTAL STRUCTURE Final Report
Carl O. Bowin 20 Feb. 1976 37 p refs
(Contract NAS9-12563)
(NASA-CR-147508) Avail: NTIS HC $4.00 CSCL 03B

Lunar gravitational properties were analyzed along with the development of flat moon and curved moon computer models. Gravity anomalies and mascons were given particular attention. Geophysical and geological considerations were included, and comparisons were made between the gravitional fields of the Earth, Mars, and the Moon. D.M.L.

N76-20051*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLASMA IRREGULARITIES IN THE COMET'S TAIL
L. C. Lee Mar. 1976 13 p refs Submitted for publication
(NASA-TM-X-71084; X-602-76-63) Avail: NTIS HC $3.50 CSCL 03B

The fluctuations in the intensity of radio source PKS 2025-15 during its occultation by Comet Kohoutek (1973f) on January 5, 1974, can be interpreted as scintillations due to the turbulent plasma in the Comet's tail. It was found that the rms fluctuation of the electron density in the Comet's tail is about 200 electrons/cu cm, the inner scale of the fluctuation is about 8 x 10 to the 7th power cm and the largest scale of fluctuation may reach 6 x 10 to the 10th power cm. Author

N76-20052*# Transemantics, Inc., Washington, D.C.
RESULTS OF RECENT STUDIES OF MARS AND VENUS
N. L. Lukashevich NASA Feb. 1976 60 p refs Transl. into ENGLISH from the book "Itogi Nauki i Tekhniki. Seriya: Issledovaniye Kosmichesogo Prostranstva, Tom 6. Nekotoryye Problemy Sozdaniya i Otrabotki Kosmicheskikh Apparatov, Prednaznachennykh dlya Vkhoda y Atmosfery Planet" Moscow, VINITI, 1975 p 7-64
(Contract NASw-2792)
(NASA-TT-F-16848) Avail: NTIS HC $4.50 CSCL 03B

Due to the launching of a series of robot space stations major advances have been made in research on earth's nearest neighbors, the planet Venus and Mars. Flights of spaceships, together with the perfection of the technology of observations made on earth, have made possible the receipt of essentially new data revolutionizing existing conceptions about the nature of these planets. Data on Mars and Venus gathered in the last 3-4 years with the aid of measurement from the Venus and Mars robot space stations, as well as from the Mariner spaceships is reviewed. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-20053*# Transemantics, Inc., Washington, D.C.
GEOGRAPHIC AND CLIMATIC VARIATIONS OF EXPOSURE

OF SOLAR ENERGY ON HORIZONTAL AND VERTICAL RECEIVING SURFACE
R. Dogniaux NASA 24 Mar. 1976 201 p Transl. into ENGLISH from the book "Variations Geographiques et Climatiques des Expositions Energetiques Solaires sur des Surfaces Receptrices Horizontales et Verticales" (Belgium), 1975 p 1-189
(Contract NASw-2792)
(NASA-TT-F-16912) Avail: NTIS HC $7.75 CSCL 03B

Tabulated data are presented which deal with the energetic exposure of the outside of horizontal and vertical surfaces to solar radiation. The surfaces were directed towards the four principal points of the compass under various atmospheric conditions (clear sky and cloudy sky) and at different latitudes (0 deg to 60 deg at intervals of 10 deg). Author

N76-20054*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATLAS OF SKYLAB ATM/S056 SUPER-LONG EXPOSURES AND STEPPED-IMAGE FRAMES
Robert M. Wilson Feb. 1976 52 p refs
(NASA-TM-X-64992) Avail: NTIS HC $4.50 CSCL 03B

A description is given of Skylab and exposure information regarding the S-L pictures is tabulated. Frames which display stepped images are identified. Author

N76-20055*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATLAS OF SKYLAB ATM/S056 CORONAL HOLE OBSERVATIONS
Robert M. Wilson 15 Mar. 1976 28 p refs
(NASA-TM-X-64994) Avail: NTIS HC $4.00 CSCL 03B

An atlas of coronal hole observations (Patrol Long and Single Frame Long Filter 3) recorded by the Skylab Apollo Telescope Mount/S056 X-ray Telescope during the first two manned missions is presented. A total of 279 operations (excluding super long frames) were determined. Comparisons are made between coronal hole observations performed in the first manned mission and those in the second manned mission, and between a super long filter 3 image and a typical single frame (or Patrol) long image. Additional studies to enhance the S056 coronal hole observations and perhaps to extend coverage into the last manned mission are suggested. The data presented are in preliminary form. Author

N76-20056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY AND MICROWAVE EVIDENCE FOR TWO PHASES OF ACCELERATION IN SOLAR FLARES
T. Bai (Maryland Univ., College Park) and R. Ramaty Mar. 1976 30 p refs Submitted for publication
(NASA-TM-X-71083; X-660-76-58) Avail: NTIS HC $4.00 CSCL 03B

Relativistic electrons in large solar flares produce gamma ray continuum by bremsstrahlung and microwave emission by gyrosynchrotron radiation. Using observations of the 1972, August 4 flare, the electron spectrum and the physical properties of the common emitting region of these radiations were evaluated. Information was also obtained on energetic protons in this flare by using gamma ray lines. From the electron spectrum, the proton-to-electron ratio, and the time dependences of the microwave emission, the 2.2 MeV line and the gamma ray continuum, it was concluded that in large solar flares relativistic electrons and energetic nuclei are accelerated by a mechanism which is different from the mechanism which accelerates approximately less than 100 keV electrons in flares. Author

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-20057 California Univ., Berkeley.
FAR INFRARED SPECTROMETRY OF THE COSMIC BACKGROUND RADIATION Ph.D. Thesis
John Cromwell Mather 1974 214 p
Avail: Univ. Microfilms Order No. 76-6652

Experiments to measure the cosmic background radiation near 1 mm wavelength are described. A ground-based search for spectral lines, was made with a Fabry-Perot interferometer and an InSb detector. The measurements were also made with a balloon-borne Fourier transform spectrometer, which is a polarizing Michelson interferometer cooled in liquid helium and operated with a germanium bolometer. The theory of operation, construction details and experimental results are presented. The first experiment was successfully completed but the second suffered equipment malfunction on its first flight. The theory of Fourier transformations is reviewed and convolutional phase correction computations are considered. Far infrared bolometer calibration procedures are discussed and test results are tabulated. Methods of improving bolometer sensivity with immersion optics and with conductive film blackening are described.
Dissert. Abstr.

N76-20058*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE AGE OF COSMIC RAYS AS DERIVED FROM THE ABUNDANCE OF Be-10 Ph.D. Thesis - Maryland Univ.
Frank Andrew Hagen Feb. 1976 200 p refs
(Grant NGR-21-002-033)
(NASA-TM-X-71085; X-660-76-54) Avail: NTIS HC $7.50 CSCL 03B

The isotopic composition of cosmic ray Be, B, C, and N was studied using a new range versus total light technique. Special emphasis was placed on the Be isotopes and in particular, on the radioactive isotope Be-10 due to its mean lifetime against decay. The experiment consisted of a thin trigger scintillator, an acrylic plastic Cerenkov detector and a spark chamber, followed by a totally active stack of 14 scintillation detectors. This stack of scintillators made possible the measurement of range, and also permitted the removal of interacting events by continuously monitoring their identities along their trajectories. The experiment was carried by balloon to atmospheric depths ranging from 3.5 to 5.0 g sq cm residual atmosphere for a total exposure time of 23 hr. Results indicate the survival of (55 + or -21) % of the Be-10 in the arriving cosmic rays; the data were interpreted using the leaky box model of cosmic ray propagation. Author

N76-20059*# Wisconsin Univ., Madison. Space Science and Engineering Center.
OSO-8 SOFT X-RAY EXPERIMENT (WISCONSIN) Final Report
10 Aug. 1975 75 p refs
(Contract NAS5-11361)
(NASA-CR-144736; OPR-64) Avail: NTIS HC $4.50 CSCL 03B

Information for operating and reducing data from the experiment which was designed to map low energy X-ray background emissions from 130 eV to 35 keV is presented. The detectors, counters, data system, and the gas system are discussed along with the functional operation of the subsystems. A command list indicating preconditions and resulting telemetry response for each command is included. F.O.S.

N76-20060# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ASYMPTOTIC DIRECTIONS AND VERTICAL CUTOFF RIGIDITIES FOR SELECTED COSMIC-RAY STATIONS AS CALCULATED USING THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD MODEL APPROPRIATE FOR EPOCH 1975.0
M. A. Shea and D. F. Smart 5 May 1974 107 p refs
(AF Proj. 8600)
(AD-A015736; AFCRL-ERP-510; AFCRL-TR-75-0247) Avail: NTIS CSCL 04/1

Tables of asymptotic directions and vertical cutoff rigidities for a selected set of cosmic-ray stations are presented. These values were obtained by the integration of vertically incident cosmic-ray trajectories through the International Geomagnetic Reference Field model adjusted for a 1975.0 Epoch. The table of asymptotic directions contains the asymptotic latitudes and

longitudes that specify the direction of approach from interplanetary space of a cosmic-ray particle. These asymptotic directions are given for specific rigidities above the main cone cutoff rigidity for each station, and at 0.01 GV rigidity intervals throughout the penumbra. Maps of the asymptotic directions for each station are also included. The table of vertical cutoff rigidities contains the geographic coordinates and L value of each cosmic-ray station together with the main cone cutoff rigidity, the Stormer cutoff rigidity, and the effective cutoff rigidity.

Author (GRA)

N76-20061# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

TABLES OF ASYMPTOTIC DIRECTIONS AND VERTICAL CUTOFF RIGIDITIES FOR A FIVE DEGREE BY FIFTEEN DEGREE WORLD GRID AS CALCULATED USING THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD FOR EPOCH 1965.0 Environmental Research Papers

M. A. Shea and D. F. Smart 17 Jul. 1975 166 p refs

(AF Proj. 8600)

(AD-A015739; AFCRL-ERP-524; AFCRL-TR-75-0381) Avail: NTIS CSCL 04/1

Tables of asymptotic directions and vertical cutoff rigidities for a five degree by fifteen degree world grid are presented in this report. These values were obtained by the integration of vertically incident cosmic-ray trajectories through the International Geomagnetic Reference Field for Epoch 1965.0. The table of asymptotic directions contains the asymptotic latitudes and longitudes which specify the direction of approach, from interplanetary space, of a cosmic-ray particle. These asymptotic directions are given for each grid point for specific rigidities above the main cone cutoff rigidity. The table of vertical cutoff rigidities contains the geographic coordinates and L value of each location together with the main cone cutoff rigidity, the Stormer cutoff rigidity, and the effective cutoff rigidity.

Author (GRA)

99 GENERAL

N76-19185* Chrysler Corp., Detroit, Mich. Defense Div.

DISPERSION DEVELOPMENT PROGRAM

D.J. Carlson, R.J. Lusardi, and W.H. Phillips *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. Aug. 1975 p 175-186

(For availability see N76-19172 10-12)

(Contract DAAA21-72-C-0030)

CSCL 16C